REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region 5

FEASIBILITY STUDY REPORT
OMC WAUKEGAN HARBOR SITE
Waukegan, Illinois

Remedial Investigation/Feasibility Study

WA No. 042-RICO-0528/Contract No. EP-S5-06-01

October 2008

PREPARED FOR

U.S. Environmental Protection Agency

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Executive Summary

This feasibility study report presents the results of the remedial action objectives (RAOs) development, technology screening, and alternative development and evaluation completed for the Waukegan Harbor ("harbor") Operable Unit (OU) of the Outboard Marine Corporation (OMC) Superfund site in Waukegan, Illinois. The object of the feasibility study was to develop alternatives that will remediate or control contaminated media remaining at the site to provide adequate protection of human health and the environment.

RAOs for the media of concern were developed to protect human health and the environment based on the nature and extent of the contamination, resources that are currently and potentially threatened, and potential for human and environmental exposure as determined by the human health and ecological risk assessments. To meet the RAOs, preliminary remediation goals (PRGs) were developed to define the extent of contaminated media requiring remedial action at the harbor.

Consistent with the RAOs and PRGs, remedial technologies and process options were identified and screened. Remedial technologies and process options that remained following screening were assembled into a range of alternatives. The potential alternatives encompass, as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but vary in the degree to which long-term management of residuals or untreated waste is required.

Based on the risks present at the site and the remaining remedial technologies and process options available after completion of the screening, five alternatives were assembled and then evaluated against the seven criteria identified in the NCP. As required, no further action was one of the alternatives evaluated.

- Alternative 1—No Action
- Alternative 2—Environmental Dredging and Sediment Disposal
- Alternative 3—Capping of Slip 4 and North Harbor, Environmental Dredging, and Sediment Disposals
- Alternative 4—Capping of Slip 4, North Harbor, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Sediment Disposal
- Alternative 5—Capping

There are no principal threat wastes in Waukegan Harbor for the evaluation of the reduction of toxicity, mobility and volume by treatment.

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Acronyms and Abbreviations

AOC	area of concern
ARARs	Applicable and relevant and appropriate requirements
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CKD	cement kiln dust
CWA	Clean Water Act
DWA	depth weighted average
FR	Federal Register
FS	feasibility study
ft^2	square feet
GAC	granular activated carbon
GIS	geographic information system
GLNPO	Great Lakes National Program Office
GMCV	genus mean chronic value
GMS	groundwater monitoring system
gpm	gallons per minute
GPS	global positioning system
HDPE	high-density polyethylene
HI	Hazard Index
IAC	Illinois Administrative Code
IDPH	Illinois Department of Public Health
IDW	inverse distance weighted
IEPA	Illinois Environmental Protection Agency
IJC	International Joint Commission
km	kilometer
LDR	land disposal restrictions
LWD	low water datum
mg/kg	milligrams per kilogram (approximately equivalent to parts per million)
mg/L	milligrams per liter (approximately equivalent to parts per million)
MNR	monitored natural recovery
NCP	National Contingency Plan
ND	not detected
ng/L	nanograms/liter (approximately equivalent to parts per trillion)
Np	Neighbor points
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OMC	Outboard Marine Corporation
OU	operable unit
PCB	polychlorinated biphenyls
ppm	parts per million (approximately equivalent to mg/kg)
QA	quality assurance

QC	quality control
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RL	reporting limit
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
SMZ	soil management zone
SOW	statement of work
SWAC	surface-weighted average concentration
TACO	Tiered Approach to Corrective Action Objectives
TBC	to be considered
TEM	transmission electron microscopy
TMV	toxicity, mobility, or volume
TSCA	Toxic Substances Control Act
TSS	total suspended solids
μg/L	micrograms per liter (approximately equivalent to parts per billion)
μm	micrometers
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
WCP	Waukegan Manufactured Gas & Coke Plant
yd^3	cubic yards

SECTION 1

Introduction

1.1 Purpose

This feasibility study (FS) report presents the result of the remedial action objectives (RAOs), technology screening, and alternatives development and evaluation completed for the Waukegan Harbor (“harbor”) Operable Unit (OU) of the Outboard Marine Corporation (OMC) Superfund site in Waukegan, Illinois. CH2M HILL performed for the U.S. Environmental Protection Agency (USEPA) in accordance with the statement of work (SOW) for Work Assignment No. 042-RICO-0528.

The remedial alternatives developed for the harbor encompass, as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a range of potential alternatives in which treatment is used to reduce the toxicity mobility, or volume (TMV) of wastes, but vary in the requirements for long-term management of residuals or untreated waste. There are no principal threat wastes in Waukegan Harbor to be included in the evaluation of the reduction of toxicity, mobility, and volume by treatment.

The alternatives were evaluated against the seven NCP criteria. Two additional criteria to be used in the evaluation of alternatives and the selection of the remedy—state/federal acceptance and community acceptance—will be addressed following public comment of the FS.

Based on current uses and historical activities, the harbor has been divided into segments that are treated as individual areas. The development of potential remedial measures within each segment is based on the levels of contamination, the thickness and physical properties of the sediments, and current and future site uses. The most effective remedial option for the harbor may, therefore, incorporate different technologies to address contamination in the individual harbor segments.

1.2 Report Organization

This document is comprised of six sections. Section 1 presents an introduction and site description including background information, such as description, history, land use, previous investigations and dredging operations, physical and chemical characteristics of the site, and summary of estimated risks. Section 2 presents the applicable or relevant and appropriate requirements (ARARs) and the RAOs. Section 3 summarizes the identification and screening of the technology types and process options. Section 4 summarizes the development of the alternatives. Section 5 presents the evaluation of the alternatives individually and to one another with respect to the NCP criteria. Section 6 provides a list of the references cited.

1.3 Site Description

Waukegan Harbor is located on the western shore of Lake Michigan, about 40 miles north of Chicago, Illinois in the City of Waukegan (City), Illinois, and 10 miles south of the Illinois/Wisconsin border. Based on current uses and historical activities, the harbor has been divided into the following harbor segments (Figure 1):

- Approach Channel
- Outer Harbor
- Entrance Channel
- Inner Harbor
- Marina
- Inner Harbor Extension
- Slip 1
- North Harbor (includes Slip 4)

The federal navigational channel of Waukegan Harbor includes the Approach Channel, Outer Harbor, Entrance Channel, the Inner Harbor, and the Inner Harbor Extension (Figure 1). The Approach Channel is not included as part of this evaluation. A variety of land uses and activities are situated around the Harbor (Figure 2).

1.4 Background

Waukegan Harbor is part of the OMC Superfund site that includes four OUs: the Waukegan Harbor site (OU 1), the Waukegan Manufactured Gas and Coke Plant site (OU2) on the eastern edge of the harbor, the polychlorinated biphenyl (PCB) containment cells (OU3) on the northern portion of OMC Plant 2 and in former Slip 3 in which thermally treated, PCB-impacted sediment and untreated PCB-contaminated soil are managed, and the OMC Plant 2 site (OU 4) north of the harbor (Figure 2). OMC Plant 2 is the source of the PCB contamination in Waukegan Harbor sediments, causing the harbor to be listed as an International Joint Commission (IJC) Great Lakes Area of Concern (AOC). In February 1992, OMC completed a sediment remediation project in the harbor that entailed the dredging, treatment, and disposal of approximately 38,000 cubic yards (yd^3) of PCB-contaminated sediment from the North Harbor area. Dredged sediments were placed in a permanent containment cell constructed in the former Slip 3. Remediated sediments contained an estimated 1,000,000 pounds of PCBs with a maximum PCB concentration of 500,000 parts per million (ppm, approximately equivalent to milligrams/kilogram [mg/kg]). Sampling of surficial sediments conducted in 1996 indicated moderate levels (typically less than 25 ppm) of PCB contamination throughout the harbor from the North Harbor area down to the Entrance Channel. OMC dredged the North Harbor to achieve a cleanup level of 50 ppm for PCBs.

The OMC remediation project also included removal or plugging of pipes that discharged PCBs into Waukegan Harbor (via the Slip 3 outfall). Other surface drainage systems were also excavated, covered, or filled in as a result of the OMC cleanup action and no longer exist. There are currently no additional known sources contributing PCBs to the harbor.

Carp fillets taken from Waukegan Harbor in 2000 and 2001 averaged 4.5 and 3.8 ppm PCB, respectively, exceeding the State of Illinois' (State's) do-not-eat criteria of 1.9 ppm. PCB concentrations in other fish, such as rock bass (estimated to be 0.5 ppm for fillets) also exceeded the State's safe level for fish of 0.05 ppm PCB. In 2003, USEPA estimated that PCB levels in the harbor sediments would need to be lowered about five-fold to reach a cancer level of 1 in 10,000 (level for fish advisories) and about ten-fold to achieve an acceptable non-cancer risk.

In 2002, USEPA Region 5's Superfund Division conducted its second 5-year review of the OMC site which determined that cleanup actions implemented in 1992 remain protective of human health and the environment. USEPA determined that the 50 ppm PCB cleanup level (set forth in the 1984 Record of Decision [ROD]) to address the PCB-contaminated harbor sediments may not be protective because PCB levels in harbor-caught fish were still above action levels and the PCB remediation levels at other sediment sites were being set as low as 0.25 to 1.0 ppm. USEPA recommended that further investigations be conducted to determine the extent of PCB contamination remaining in the harbor and to evaluate impacts of PCB levels in sediment on PCB levels in the fish (USEPA, 2002).

1.5 Summary of Recent USEPA Investigations

Additional investigations were conducted in the harbor by the USEPA's Great Lakes National Program Office (GLNPO) in January 2003, January 2005, and November 2006 through March 2007. The GLNPO investigations included the following:

- **Sediment core and till sampling**—Collection and laboratory analysis of sediment core samples from the top of the sediment to the till surface from 90 locations throughout the harbor (includes selected sample data from 2003). A total of 600 samples were analyzed for PCBs. In addition, 53 samples were analyzed for geotechnical characteristics in 2005 through 2007.
- **Containment cell sampling**—Collection of material from 10 total locations from the West Containment Cell (4 locations) and the East Containment Cell (6 locations) to determine characteristics of the materials within the cells.
- **Bulk sediment sampling**—Bulk sediment collected from six areas within the harbor to provide representative samples for treatability testing of dewatering and wastewater processes.
- **Harbor water sampling**—Collection and laboratory analysis of both undisturbed and disturbed water samples to evaluate water quality of the harbor and the impacts to water quality as commercial ships enter and leave the harbor.

1.6 Major Findings

1.6.1 Physical Site Characteristics

Waukegan Harbor is an active harbor that currently supports recreational and commercial shipping. The harbor is a largely man-made structure that comprises 35 to 40 acres, with water depths varying from 8 to 24 feet. Nearly the entire harbor is bordered by steel sheet piling except in the Marina and along both of the north and south piers (see Figure 2). The harbor has no tributary flow.

The generalized stratigraphy of the sediments in Waukegan Harbor (from highest elevation to lowest elevation) includes the following:

- Soft, organic silt and/or clay with relatively high organic content and moisture content ranging in thickness from about 0.5 to 10.5 feet.
- Loose to moderately dense, medium-grained sand with some silt and clay with approximately half the amount of organic and moisture content as measured in the overlying or underlying silts and clays.
- Very stiff, firm, silty clay till with trace sand, low plasticity, and relatively low moisture content encountered beneath softer sediment at elevations ranging from -12 to -29 feet low water datum (LWD).

All three layers are not always present, and sometimes the sand is interlayered with the silt material. Figure 3 depicts the percentage of coarse material (sand plus gravel fraction) at various locations across the harbor calculated as a depth-weighted average (DWA) over the entire sediment column. The total volume of sediment above the clay till within all of the Waukegan Harbor segments except the Approach Channel is estimated to be more than 578,000 yd^3. Harbor thicknesses, by segment, are discussed in Section 1.6.2, below.

Lake Michigan influences Waukegan Harbor by the nearly continual exchange of water between the lake and harbor caused by wind-induced seiches and mixing from direct waves entering the harbor through the Entrance Channel. Propellers and bow-thrusters from large ships and boats also re-suspend and move the sediment.

1.6.2 Nature and Extent of Contamination

The findings of the field investigation relative to the nature and extent of contamination at the harbor are described below.

Harbor Water

Historical sample results for the harbor indicated water quality conditions were worse in the innermost reaches of the harbor and improved toward the harbor mouth. Ammonia, cyanide, phenols, and dissolved oxygen were at concentrations causing the most concern. Harbor water samples were collected during the 2007 GLNPO investigation to evaluate the effects of ship propellers on re-suspending sediment and the resulting water column contaminant concentrations. The analytical results for the baseline sample (collected prior to shipping activity) included detections of phosphorus, total ammonia nitrogen, hardness, total organic carbon, total suspended solids (TSS), total volatile solids, arsenic, copper, and mercury. Total PCBs were not detected in this “undisturbed” baseline sample.

PCBs in Sediment or Clay Till

The horizontal and vertical delineations of PCBs in the sediment or clay till were evaluated based on total PCB concentrations rather than individual Aroclor concentrations. The analytical data indicate that two Aroclors (1016 and 1232) were not detected in any of the samples. Hence, the calculation of total PCBs includes the five Aroclors detected in harbor sediment: 1221, 1242, 1248, 1254, and 1260. The method used to calculate total PCB concentrations for each sample consisted of summing the concentration of each detected Aroclor plus one-half the reporting limit (RL) for all non-detected Aroclors. For instances in which all Aroclor values were at or below the limit of detection, one half of the RL for each Aroclor was used to represent the "Total" value, even though none of the individual Aroclors were detected—on figures and tables listing this total value, a "ND" (not detected) has been noted next to the value.

Sediment

Of the five separate PCB compounds detected within Waukegan Harbor sediments, Aroclor 1248 was detected at both the highest concentrations and most frequency. The frequency and distribution of total PCBs in the Waukegan Harbor sediments are based on the data from 600 sediment samples collected from 90 sediment core locations throughout the harbor. At least one PCB Aroclor was detected in 83 percent of the samples (495 of 600 samples). The average total PCB concentration within the harbor using all 600 sediment core samples is 2.2 ppm.

The maximum PCB concentrations in sediment were detected in the vicinity of the North Harbor, Inner Harbor, and Marina (Figure 4), with the highest PCB concentration of 36.6 ppm from a sample collected in the Marina. In general, the highest PCB concentrations occurred in sediment at depths of less than 3 feet (Figure 5). Cross sections (Figures 6A through 7B) were constructed along the two major axis of the harbor presenting the total PCB results from the cores sampled from the top of the sediment to the till surface. The locations of the cross sections are presented on Figure 4. A summary of observations for each harbor segment is as follows:

- **Slip 4**—Sediment thickness is consistent within the slip, ranging between 7 and 13 feet (average thickness of 8.9 feet). The average concentration of total PCBs in the Slip 4 sediment is 0.21 ppm, with concentrations ranging between 0.24 and 0.45 ppm at locations where at least one Aroclor was detected.

- **North Harbor**—The sediment in the North Harbor ranges from 0 feet to a thickness of approximately 14 feet (average thickness of 3.5 feet) with total PCB concentrations exceeding 20 ppm in at least three locations. The average total PCB concentration in this segment is 4.9 ppm with concentrations ranging from 0.12 to 26.9 ppm at locations where at least one Aroclor was detected. The sediment from the northernmost portion of the North Harbor (i.e., closer to former source) contains the highest concentrations.

- **Inner Harbor Extension**—Sediment thickness in this segment ranges from 0 to 9 feet (average thickness of 1.7 feet) with a small zone in the southernmost portion that is 14 feet thick. The average total PCB concentration is 1.8 ppm with concentrations ranging from 0.14 to 9.3 ppm at locations where at least one Aroclor was detected.

- **Inner Harbor**—The main shipping channel of the Inner Harbor has almost no measurable thickness of sediment. The sediment along the northwestern and southwestern sidewalls was measured to be up to 10 and 14 feet, respectively. The southern portion of the Inner Harbor has up to 11 feet of sediment. Higher concentrations (up to 7.47 ppm) of total PCBs in sediments were detected at depths of about 6 feet. The entire sediment column in the western portion of the Inner Harbor (contiguous with the Marina) was found to be contaminated with total PCB concentrations ranging from 1.7 to 9.6 ppm. The average total PCB concentration of the entire Inner Harbor segment is 4.0 ppm, with a concentration range of 0.13 to 32.3 ppm at locations where at least one Aroclor was detected.

- **Slip 1**—The sediment thickness in Slip 1 ranges from less than one-tenth of a foot where boat traffic is centered to almost 13 feet near the seawalls. The total PCB concentrations range from 0.51 to 16.7 ppm at locations where at least one Aroclor was detected with the highest concentration occurring in the northern portion. The average total PCB concentration in Slip 1 is 4.6 ppm.
- **Marina—**Sediment thickness in the Marina ranges between 2 and 14 feet (average thickness of 9 feet). Consistent total PCB concentrations exist throughout the sediment column in the northernmost portion of the Marina. The average total PCB concentration in the Marina is 3.4 ppm with concentrations ranging from 0.10 to 36.6 ppm at locations where at least one Aroclor was detected.
- **Entrance Channel**—The Entrance Channel sediment thickness varies from approximately 2 to 8 feet along its length and up to 15 feet along the northern wall (average thickness of 7.3 feet). The average total PCB concentration is 1.0 ppm with a concentration range of 0.079 to 8.4 ppm total PCBs at locations where at least one Aroclor was detected.
- **Outer Harbor —**The Outer Harbor has a sediment thickness range of between 6 and 15 feet. The average total PCB concentration for samples in this segment is 0.23 ppm with a concentration range of between 0.11 and 1.5 ppm total PCBs at locations where at least one Aroclor was detected.

Clay Till

Forty-four (44) samples throughout the harbor were taken from the interval including the top of the clay till beneath softer sediment. PCBs were detected in 15 of the 44 clay till samples, with total PCB concentrations ranging from 0.109 to 0.416 ppm at locations where at least one Aroclor was detected (Figure 8). The results indicate that the till is not significantly impacted by PCBs that occur in the unconsolidated sediment.

Asbestos in Sediment

The potential presence of asbestos in harbor sediment was evaluated due to the presence of numerous possible sources located at least a mile north from the harbor on Lake Michigan (University of Illinois at Chicago, 2005). Qualitative results for 58 asbestos samples collected from the sediment throughout the entire harbor in 2005 indicated trace amounts (less than 1 percent) of asbestos in 11 samples. Quantitative analysis of the 11 samples found only one sample containing trace amounts of chrysotile (CH2M HILL, 2005).

In 2006, the U.S. Army Corps of Engineers (USACE) collected 12 sediment samples from the Outer Harbor segment and analyzed them for asbestos using a quantitative method—transmission electron microscopy (TEM). Of the 12 samples analyzed, 4 contained detectable levels of asbestos fibers ranging from 1 million to 3.9 million fibers per gram of respirable material (i.e., particles smaller than 10 micrometers [µm]). USEPA assumes that sediments within the inner harbor segments would contain smaller amounts of asbestos because they are even farther away from the asbestos possible source areas identified north of the harbor on Lake Michigan.

Fish Tissue

Fish samples have been collected from Waukegan Harbor (Station Code QZO-01) on an annual basis by the Illinois Environmental Protection Agency (IEPA) since 1996 (with the exception of 2002). The average PCB concentration in all fish from the 2001 to 2005 data set (24 samples) was 2.62 ppm and from the 2003 to 2005 data subset (12 samples) was 0.57 ppm, supporting an overall trend of decreasing PCB concentration levels in fish tissue.

1.6.3 PCB Fate and Transport

PCBs strongly adsorb to soil particles, have low water solubility, are persistent in the environment (do not readily break down), and, thus, do not show much migration in a given environment. Adsorbed PCBs will move primarily with the sediments they are sorbed to—the amount of movement will depend on the location within the harbor. Sediment movement within and/or out of Slip 4, the northern end of the North Harbor, and the Marina is expected to be minimal—the only re-suspension of sediment within these segments would be due to recreational marine traffic. More transport within the harbor would be expected in Slip 1 and the navigational segments of the harbor because of re-suspension of shallow sediment from propeller wash by the deep draft commercial vessels. Very shallow sediments in the segments near the harbor entrance (Entrance Channel and Outer Harbor) would also be influenced by wind-induced seiches and waves entering the harbor.

1.6.4 Human Health Risk Evaluation

PCBs in Sediment

PCBs do not appreciably degrade or easily attenuate, but bioaccumulate in harbor fish that may be eaten by humans. In July 2003, USEPA evaluated the short- and long-term risks associated with PCB contamination existing in Waukegan Harbor sediments (Clark, 2003). The 2003 risk evaluation indicated that the average PCB level in the harbor area sediments needed to be reduced about five-fold to reach a cancer level of 1 in 10,000 (level for fish advisories) and about ten-fold to achieve an acceptable non-cancer risk (Clark, 2003). In 2006, an additional risk evaluation was performed using fish tissue results collected during 2001 to 2005 and indicated that a surface-weighted average concentration (SWAC) of 0.2 ppm total PCBs in sediment will protect high-rate consumers of fish from the harbor (CH2M HILL, 2006). In 2008, USEPA updated the risk assessment for the harbor based on the fish tissue data set and estimated an excess lifetime cancer risk of 2.0×10^{-4} and a non-cancer Hazard Index (HI) of 11.4 for adult high-end consumers using USEPA's reference dose value for PCBs. Based on the HI value of 11.4, such risk to adults is more than an order of magnitude greater than acceptable levels and indicate potential immune, reproductive, and cognitive risks. The HI value for infants and children, based upon methodology used for the Fox River, was found to be 2.5 times higher than the adult value or 28.5 (Clark, 2008).

PCBs in Fish Tissue

In February 2006, the Illinois Department of Public Health (IDPH) issued a state-wide sports fish consumption advisory for Illinois waters that included the "Waukegan North Harbor of

Lake Michigan" (the "Waukegan North Harbor" includes the entire Waukegan Harbor OU). IDPH recommended that meals of white sucker and sunfish taken from the harbor be limited to one per month due to the elevated levels of PCBs in fish. All other species caught in the harbor should follow the advisory for Lake Michigan fish concerning PCB and methylmercury levels (USEPA, 2007). In January 2008, IDPH updated the state-wide sports fish consumption advisory for Illinois waters which includes the "Waukegan North Harbor of Lake Michigan."

Asbestos in Sediment

Because there were detectable levels of asbestos fibers in a small sample set collected from the Outer Harbor sediment, the USACE evaluated the potential risk to human health from potential reuse of the material. The 2006 evaluation by the USACE indicated there is no further risk evaluation required for the material, and that the Outer Harbor sediment could be re-used on land without further consideration of asbestos risk (USACE, 2006).

1.6.5 Ecological Risk Assessment for PCBs

Factors that limit Waukegan Harbor's value as a habitat include regular industrial boat traffic that stirs up and muddies the harbor waters, dredging operations that disturb harbor sediments and affect surface water quality, and the lack of cover provided by the deep, vertical harbor walls (CH2M HILL, 1995). Terrestrial habitat exists immediately adjacent to the harbor, but is limited to maintained/mowed grassy areas (e.g., the Waukegan Manufactured Gas & Coke Plant [WCP] site, the former Slip 3 containment cell, and Warren Siver Park), gravel areas, and paved parking lots. Wetland areas do not occur immediately adjacent to the harbor. None of these areas support significant terrestrial habitat.

Fish and macroinvertebrates reside in harbor waters and have limited or nonexistent mobility, indicating these species are likely to spend a major portion of their entire life cycle within the study area. The Lake Michigan sport fishing catch consists primarily of yellow perch, chinook and coho salmon, steelhead, brown, and lake trout. Two state-threatened fish species, the longnose sucker and the lake whitefish, have been reported in Lake Michigan between Zion and Waukegan. The last sightings of these species were in 1985 for the longnose sucker, and in 1991 for the lake whitefish (CH2M HILL, 1995).

The USEPA completed a sediment toxicity study for the harbor in 1999, representing post-remediation conditions (USEPA, 1999). The results of the study are generally applicable to current conditions as additional dredging activities have not been conducted and PCBs do not appreciably degrade or easily attenuate. Sediment samples from Waukegan Harbor were generally found to be not lethal to amphipods—only 6 of the 20 sediment samples were toxic. However, amphipod growth was significantly reduced in all of the sediment samples compared to the control sediment after both 28 and 42 day time periods. The available guidelines during the study for evaluation of Great Lake harbor sediment classified sediment samples as moderately toxic if total PCB concentrations range from 1 to 10 mg/kg. Based on the criteria, 18 of 19 sediment samples used in this study would be classified as moderately toxic based on their total PCB concentrations (USEPA, 1999).

SECTION 2

Development and Identification of ARARs and RAOs

2.1 Summary of Applicable or Relevant and Appropriate Requirements

Remedial actions must be protective of public health and the environment. Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that primary consideration be given to remedial alternatives that attain or exceed ARARs. The purpose of this requirement is to make CERCLA response actions consistent with other pertinent federal and state environmental requirements, as well as to adequately protect public health and the environment.

Definitions of the ARARs and the "to be considered" (TBC) criteria are given below:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that directly and fully address a hazardous substance, pollutant, contaminant, environmental action, location, or other circumstance at a CERCLA site.
- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, which while not "applicable," address problems or situations sufficiently similar (relevant) to those encountered at a CERCLA site, that their use is well suited (appropriate) to the particular site.
- TBC criteria are non-promulgated, non-enforceable guidelines or criteria that may be useful for developing a remedial action, or are necessary for evaluating what is protective to human health and/or the environment. Examples of TBC criteria include IEPA Tiered Approach to Corrective Action Objectives (TACO) Tier 1 remediation objectives, USEPA drinking water health advisories, reference doses, and cancer slope factors.

Another factor in determining which requirements must be addressed is whether the requirement is substantive or administrative. "Onsite" CERCLA response actions must comply with the substantive requirements but not with the administrative requirements of environmental laws and regulations as specified in the NCP, 40 Code of Federal Regulations (CFR) 300.5, "Definitions of ARARs" and as discussed in 55 Federal Register (FR) 8756. Substantive requirements are those pertaining directly to actions or conditions in the environment. Administrative requirements are mechanisms that facilitate the implementation of the substantive requirements of an environmental law or regulation. In general, administrative requirements prescribe methods and procedures (for example, fees, permits, inspections, or periodic reports) by which substantive requirements are made effective for the purposes of a particular environmental or public health program.

ARARs are grouped into three types: chemical-specific, location-specific, and action-specific. Appendix A includes the chemical-specific, action-specific, and location-specific ARARs for the Waukegan Harbor site. The most important ARARs are discussed below. All potential ARARs are listed in Appendix A along with an analysis of the ARAR status relative to remediation of the Waukegan Harbor site.

2.1.1 Chemical-Specific ARARs

Chemical-specific ARARs include laws and requirements that establish health- or risk-based numerical values or methodologies for environmental contaminant concentrations or discharge.

Resource Conservation and Recovery Act (RCRA)

Sediment to be excavated and disposed offsite should be classified as to its RCRA status to determine whether RCRA requirements are ARARs. RCRA is not an ARAR for contaminated sediments if the sediments are remediated under the Clean Water Act (CWA) Section 404. RCRA specifically excludes sediments managed under a Section 404 permit as follows: "*40 CFR 261(g). Dredged material that is not a hazardous waste. Dredged material that is subject to the requirements of a permit that has been issued under 404 of the Federal Water Pollution Control Act (33 U.S.C.1344) or Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1413) is not a hazardous waste*." Land disposal restrictions (LDRs) apply to hazardous wastes that are intended for land disposal. Because the sediments are not hazardous waste, LDRs do not apply and are not ARARs for the sediment.

Clean Water Act

The CWA provides regulations for the discharge of pollutants into the waters of the United States. It required USEPA to set water quality standards for all contaminants in surface waters, and that permits are obtained for discharge of pollutants from a point source into navigable waters.

A federal program called the Great Lakes Water Quality Initiative was begun in 1989 to develop uniform water quality criteria for the Great Lakes Basin and resulted in the publication of criteria and methodologies for the development of water quality criteria. These criteria were promulgated in the Great Lakes Critical Programs Act of 1990 and are incorporated into the CFR in 40 CFR Part 132. Based on these criteria, it is likely that National Pollutant Discharge Elimination System (NPDES) limits for PCBs will be set at non-detectable levels.

Regulations promulgated under the authority of the CWA require obtaining a permit for dredging or excavation of sediments in navigable water such as Waukegan Harbor. While CERCLA response actions are not required to obtain permits, the substantive requirements that such a permit would contain must be met. As a result, consultations with USACE, the permitting agency, will be held to determine which requirements would apply to dredging and excavation of harbor sediments. Typical requirements include actions to minimize re-suspension of sediments and to control erosion during dredging or excavation.

2.1.2 Action-Specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. They generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the remedial activities selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements may apply. The action-specific requirements do not solely determine the remedial alternative, but indicate how or to what level treatment or cleanup will be achieved.

Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA requires that the selected remedy meet the substantive requirements of all environmental rules and regulations that are ARARs unless a specific waiver of the requirement is granted. A waiver of ARARs may be requested (per NCP 300.430[f][1][ii][C]) based on any one of six circumstances. It is anticipated that an ARAR waiver under CERCLA may be necessary for the discharge of water containing ammonia and some metals (e.g., mercury) to the harbor as part of sediment dewatering operations.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) regulates the remediation of soils contaminated with PCBs under 40 CFR 761.61(a), *Self-implementing on-site cleanup and disposal of PCB remediation waste*. However, this section specifically excludes remediation of sediment from the self-implementing rules. As a result, the TSCA self-implementing rules are not ARARs for the harbor sediment remediation.

Contaminated sediments are addressed under 40 CFR 761.61(b)(3), *Performance-based cleanup.* This section specifically requires that sediment dredged or excavated from waters of the United States be managed in accordance with a permit issued under Section 404 of the CWA, or the equivalent of such a permit. While a permit is not required for CERCLA response actions, consultations with USACE, the permitting agency, will be held to determine which requirements would apply to the sediment dredging and excavation.

TSCA also requires soil contaminated with PCBs at concentrations of 50 ppm or greater to be disposed of at either a hazardous waste landfill permitted under RCRA or at a chemical waste landfill permitted under TSCA. None of the sediment remaining in the harbor (as sampled) exceeds 50 ppm. As a result, the chemical waste landfill requirements under 40 CFR 761.75 do not have to be met and are not ARARs for excavated sediment. They could become ARARs, however, if further sampling identifies sediment in excess of 50 ppm.

Illinois Site Remediation Program – Soil Management Zone

The Illinois Site Remediation Program established the procedures for remedial activities at sites where hazardous substances, pesticides, or petroleum may be present. Within Section 740.535 of Title 35 of the Illinois Administrative Code (IAC), criteria are provided to establish an onsite soil management zone (SMZ) without violating the solid waste disposal regulations. SMZs can be used for onsite consolidation of contaminated soils within a remediation site. Applicability of the soil management zone requires that soils to be placed in the SMZ must have PCB concentrations less than 50 ppm; all exposure routes must be addressed, and institutional controls and engineered barriers must be used in compliance with 35 IAC 742 Subparts J and K. For the direct contact exposure route, the following engineered barriers are recognized:

1. Caps or walls constructed of compacted clay, asphalt, concrete.
2. Permanent structures such as buildings and highways.
3. Soil, gravel, or other geologic materials that cover the contaminated media and are a minimum of 3 feet thick.

Soil with contaminants exceeding criteria cannot be placed in areas of soil meeting criteria (i.e., the consolidation area also must exceed at least one of the residential Tier 1 soil remediation objective values listed in 35 IAC 742, Appendix B, Table A).

2.1.3 Location-Specific ARARs

Location-specific ARARs are requirements that relate to the geographical position of the site. State and federal laws and regulations that apply to the protection of wetlands, construction in floodplains, and protection of endangered species in streams or rivers are examples of location-specific ARARs. The most important location-specific ARARs for the Waukegan Harbor site are the following:

- Fish and Wildlife Coordination Act—Enacted to protect fish and wildlife when actions result in the control or structural modification of a natural stream or body of water. The statute requires that any action taken involves consideration of the effect that water-related projects would have on fish and wildlife, and that preventative actions are made to prevent loss or damage to these resources.
- River and Harbors Act—Section 10 prohibits the creation of obstructions to the capacity of, or excavation or fill within the limits of, the navigable waters of the United States. Typical requirements of dredging permits include measures to minimize re-suspension of sediments and erosion of sediments and stream banks during excavation.
- Endangered Species Act of 1973—Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species (e.g., piping plover) and will not destroy or adversely modify critical habitat.

2.2 Remedial Action Objectives (RAOs)

RAOs are requirements that remedial alternatives should achieve to provide adequate protection of human health and the environment while meeting ARARs (unless an ARAR waiver will be used). This section presents general and site-specific RAOs for the contaminated sediment in Waukegan Harbor.

General remedial objectives are defined in USEPA’s 1990 NCP and Section 121 of CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA). These objectives relate to the statutory requirements for remedy development. Site-specific objectives usually relate to specific contaminated media such as sediment or groundwater, potential exposure routes, and identification of target remediation levels. This analysis is focused on the contaminated sediments in Waukegan Harbor.

The RAOs for the sediment in Waukegan Harbor include the following:

- Protect human health and the environment from the adverse effects of PCBs attributable to the site.
- Remediate PCBs in sediment throughout the harbor to achieve a SWAC of 0.2 ppm by targeting a remedial action level of 1 ppm total PCBs at any single location.
- Minimize to the extent practicable potential human health and environmental risks that may be associated with remedial activities.
- Elevation to the top of sediment in the North Harbor or Marina will not be reduced to an elevation less than -12 feet LWD. This elevation was selected as the minimum elevation needed for recreational boaters currently using the harbor. Sediment removal solely for the purpose of recreational boating is not an objective for these two segments.
- Elevation to the top of sediment in the federal navigational channel will not be reduced to an elevation less than -18 feet LWD. Sediment removal solely for navigational purposes is not an objective for this project.
- Minimize to the extent practicable adverse effects on recreational and commercial shipping during remedial activities.

One of the goals for the cleanup is to maintain the depth of the inner federal navigational channel to no less than -18 feet LWD. Discussions with the National Oceanic and Atmospheric Administration have indicated that the Congressionally-authorized depth for the inner navigational channel segments of Waukegan Harbor (i.e., not including the Outer Harbor segment) is -23 feet LWD. The -18 feet LWD goal used in this FS is based on the depth that the USACE is currently authorized to maintain.

2.3 Sediment Remediation Areas

The sediment remediation areas were defined by using a three-dimensional (3-D) interpolation method to delineate the horizontal and vertical extent of sediment containing total PCB concentrations greater than 1 ppm. The horizontal and vertical distributions of total PCB concentrations and the remediation areas along the two main axes of the harbor are presented in Figures 6A through 7B. The computer application Groundwater Modeling Software v. 4.0 (GMS, produced by Environmental Modeling Systems, Inc.) was used to interpolate PCB concentrations from individual sampling points to a dense 3-D mesh. The general procedures for mesh generation and for selecting the interpolation parameters are outlined below.

Key attributes of the GMS-based interpolation approach for delineation of the 1.0-ppm PCB extent included the following:

- The dataset was limited to recent analytical results from sediment samples collected by CH2M HILL between 2005 and 2007 and the 2003 USEPA core locations that had been continuously sampled from the top of sediment to till.

- PCB concentrations were represented as point values located at corresponding horizontal coordinates (e.g., northing and easting) for each sampling station. The vertical position was represented by the sample midpoint depth below the top of the sediment surface. Field duplicate results were excluded (duplicates were obtained for analytical quality assurance [QA]/quality control [QC] purposes and were not intended, by project design, to represent multiple analyses at a single station or sample location).

- PCB concentrations were reported as total PCBs—the sum of the individual concentrations of the five Aroclors (1221, 1242, 1248, 1254, and 1260) detected in the harbor sediment. Where a mix of detects and non-detects appeared for a specific sample, the quantitative value for detected Aroclors was added to half the RL for the non-detected Aroclors. For instances in which all Aroclor values were at or below the limit of detection, one half of the RL for each Aroclor was used to represent the "Total" value, even though there were no individual Aroclors detected.

- Interpolation was performed within a 3-D mesh of each harbor segment that has a normalized, flat top sediment surface. This was necessary because the PCB concentrations were correlated with sediment depth, rather than elevation. The lower boundary of the mesh was defined by the till surface. The resultant mesh thickness at each horizontal coordinate should approximate the sediment thickness.

- Mesh spacing was set as a function of sampling intervals and other considerations. Mesh spacing in the horizontal plane was a 10-foot triangular grid with a maximum vertical spacing of 0.5 feet.

- A modified inverse distance weighted (IDW) method (also called the Shepard's method) was used to interpolate the entire PCB sample dataset to a 3-D mesh for each harbor segment. The two main parameter settings within the GMS IDW method are the vertical anisotropy factor (z-scale factor) and the number of nearest neighbor points (Np) used to define the interpolated region. Final selection of these parameters was determined by the combination that maximizes the capture of all samples with PCB concentrations greater than 1 ppm, while minimizing capture of locations known to have PCB concentrations less than 1 ppm.

Once interpolation parameters were selected, the 1.0-ppm isosurfaces (the 3-D equivalent to contours) generated by GMS were converted to the maximum depth of the occurrence of 1.0 ppm PCB concentration at each horizontal node within the mesh. The top of sediment and maximum depths were converted to elevations and used to define the volume of sediment with concentrations greater than 1ppm.

Table 1 summarizes the sediment remediation area and the volume of sediment that will need to be removed to meet the 1 ppm remedial action level. Volumes reported include an estimated average 6 inches over dredge as well as 3:1 (horizontal to vertical) side slopes along the modeled 1-ppm surface for stabilization purposes.

TABLE 1
Summary of Estimated Sediment Volume Requiring Remediation

Harbor Segment	Volume Exceeding 1 ppm (yd^3)	Lateral Area Exceeding 1 ppm (square feet [ft^2])	Existing Condition SWAC Total PCB Concentration (ppm)
Larsen Marine (Slip 4)	500	3,400	0.37
North Harbor	28,000	232,900	2.84
Inner Harbor	66,600	36,400	4.57
Inner Harbor Extension	6,000	358,500	0.63
Slip 1	3,000	75,000	3.55
Marina	68,400	134,200	1.65
Entrance Channel	22,700	271,500	0.63
Outer Harbor	0	0	0.13
Overall Harbor	**195,200**	**1,111,900**	**1.8**

Note: Two samples within the Outer Harbor have a concentration greater than 1 ppm. These locations will not be remediated because they were detected approximately 8 feet below the top of sediment and their presence does not impact the SWAC, or otherwise create a significant risk to human health or the environment.

In addition to the remedial action limit of 1 ppm total PCBs at a single location, the RAOs include achieving a SWAC for the entire harbor of 0.2 ppm. The existing SWAC for each of the harbor segments as well as the overall harbor are provided in Table 1. As shown in Table 1, the present SWAC concentration of the total PCBs in the harbor sediment exceeds the 0.2 ppm remedial goal throughout all harbor segments, except the Outer Harbor. The 0.13 ppm existing condition SWAC contribution of the Outer Harbor sediments was included in the overall SWAC calculations in order to estimate the biota's exposure to PCBs from the sediments within the entire Waukegan Harbor.

Consistent with the risk evaluation, the existing condition SWAC calculations are based on total PCB concentrations in the surface sediment. "Surface sediment" (not including clay till) is defined as the upper 0.5 feet of sediment in non-navigational areas (Slip 4, North Harbor, and Marina) and the upper 2.0 feet of sediment within navigational areas (Inner Harbor, Inner Harbor Extension, Slip 1, Entrance Channel, and Outer Harbor). The increased surface sediment thickness in the navigational areas is intended to address the potential effects of scouring and propeller wash caused by commercial vessels. When multiple samples within the respective surface sediment interval were collected at a core location, a depth-weighted average (DWA) approach was used for calculating the surface sediment PCB concentration. Once surface sediment concentrations for each of the sample locations was estimated, the resulting dataset was imported into a Geographic Information System (GIS) computer application where the SWAC for the project area and for each harbor segment was calculated using Thiessen polygon methodology.

After dredging is complete, a post-dredge SWAC will be needed to evaluate whether the 0.2 ppm remediation goal has been met. It will be calculated using the same DWA approach for each harbor segment as described for the current conditions SWAC. The post-dredge calculation will accommodate for the presence of a post-dredge residual sediment layer as well as a residual sand cover or armored cap placement (where utilized). The post-dredge SWAC calculation will assume the following conditions over the applicable harbor segments:

- A layer of residual sand cover or armored cap, where placed, with no detectable concentrations of PCBs (0 ppm).
- A residual sediment layer with PCB concentrations equal to the DWA PCB concentration of the material dredged.
- A sediment layer at the DWA concentration of the not-dredged sediment. The PCB concentration of the not-dredged sediment will be based on the concentration in soft sediments (not including till) that remain to a maximum depth of 0.5 or 2.0 feet (depending on whether the location is within a non-navigational or navigational area, respectively) to represent post-dredge surface concentrations.

A description of methods and equations used for calculating the existing condition and post-dredge SWAC are included in Appendix B.

SECTION 3

Identification and Screening of Technologies and Process Options

After the RAOs were developed, general response actions consistent with these objectives were identified. General response actions are basic actions that might be undertaken to remediate a site (for example, no action, in situ treatment, or excavation and treatment). For each general response action, several possible remedial technologies may exist. They can be further broken down into a number of process options. These technologies and process options are then screened based on several criteria. Those technologies and process options remaining after screening are assembled into alternatives presented in Section 4.

3.1 General Response Actions

General response actions that may be applicable to the project include the following:

- No action
- Monitored natural recovery
- Monitoring
- Institutional controls
- Containment
- In situ treatment
- Sediment removal
- Ex situ treatment
- Sediment dewatering
- Sediment processing and stabilization
- Water treatment
- Sediment transport
- Sediment disposal

For each general response action (except No Action), remedial technologies and associated process options considered to be potentially appropriate and effective for remediating the contaminated sediments within the various segments of Waukegan Harbor were identified based on professional experience, published sources, computer databases, and other available documentation and resources.

3.2 Identification and Screening of Technology Types and Process Options

In this section, the available technology types and process options were screened to identify technologies applicable to remediating sediments from Waukegan Harbor. This screening step may eliminate a general response action from the FS process if no feasible technologies are identified. The objective, however, is to retain the best technology types and process options within each general response action and to use them to develop remedial alternatives. Each technology type and process option is either a demonstrated or proven process, or a process that has undergone laboratory trials or bench-scale testing.

Process options were evaluated using a qualitative comparison based on effectiveness, implementability, and relative cost. Effectiveness is the ability of the process option to perform as part of a comprehensive remedial plan to meet RAOs under the conditions and limitations present at the site. The NCP defines effectiveness as the "degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risk, affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection." This is a relative measure for comparison of process options that perform the same or similar functions. Implementability refers to the relative degree of difficulty anticipated in implementing a particular process option under regulatory, technical, and schedule constraints posed by circumstances at Waukegan Harbor. At this point, the cost criterion is comparative only. Similar to the effectiveness criterion, the cost criterion is used to preclude further evaluation of process options that are costly if other lower cost choices with similar functions and similar effectiveness could be performed. The cost criterion includes costs of construction and any long-term costs to operate and maintain technologies that are part of an alternative.

The NCP preference is for solutions that use treatment technologies to permanently reduce the toxicity, mobility, or volume of hazardous substances. Available treatment processes are typically divided into three technology types—biological, physical/chemical, and thermal—which are applied in one or more general response actions. Existing sediment treatment processes, however, were found to be either not effective for PCBs at the relatively low concentrations present in the harbor, or not implementable at the scale required for the site.

The response actions and the associated remedial technologies that remain following screening are as follows:

- No action
- Monitored natural recovery (MNR)
- Monitoring through sampling and analysis of sediment or treatment effluent matrices
- Institutional controls using deed and access restrictions and fish consumption advisories
- Containment using an in situ cap or residual sand cover
- Sediment removal using dry excavation, mechanical dredging, or hydraulic dredging
- Ex situ treatment of removed sediment
- Sediment dewatering using passive or active dewatering
- Sediment processing and stabilization using particle size segregation or reagent addition
- Water treatment using clarification, filtration, and activated carbon adsorption
- Sediment transport via truck or slurry pipeline
- Sediment disposal at an offsite RCRA Subtitle D solid waste landfill or a consolidation cell on the OMC Plant 2 site.

3.2.1 No Action

Under a no action alternative, no remedial response is performed. This alternative is typically used as a baseline to which other remedial options are compared. A no action alternative may be appropriate where current site conditions present little or no human health or environmental risk.

The no action alternative is retained for the purpose of comparison with other remedial options.

3.2.2 Monitored Natural Recovery

Monitored natural recovery (MNR) involves the reliance upon naturally occurring physical, chemical, and biological processes to reduce the bioavailability and/or toxicity of contaminants to acceptable levels. For example, exposure levels are reduced by a decrease in contaminant concentration levels in the near-surface sediment zone through burial or mixing-in-place with cleaner sediment. Contaminated sediments located in depositional areas can gradually be buried by cleaner sediments. This alternative can be implemented only after all significant continuing sources of contaminants to the system have been eliminated.

Typically, MNR is required to occur within a set amount of time. A remedial alternative that involves MNR will require a comprehensive long-term monitoring program to verify that such processes are taking place and that anticipated human health and environmental risk reductions are being achieved. MNR is appropriate at sediment sites with the following conditions:

1. Sources are controlled
2. Short-term human health and environmental risks are low and/or declining
3. Institutional controls effectively restrict human exposure
4. The sediment bed is stable and likely to remain stable
5. Natural recovery processes have a high degree of certainty to continue

The bulk of the PCB contamination has been removed from Waukegan Harbor, so MNR is a potential technology for the Harbor. Conditions 1 and 2 are met in Waukegan Harbor. However, the fish advisories do not "restrict" human exposure, and the sediment bed is not likely to remain stable throughout all the Harbor segments. The harbor is closed to stream inflows; therefore, additional, natural sediment buildup will not likely occur on the majority of the Harbor bottom. Based on historical dredging operations, USACE estimated the future anticipated shoaling rates and required dredging intervals for Waukegan Harbor, as shown in Table 2. The total annual shoaling rate is about 30,000 yd^3 of material (USACE, 1995).

TABLE 2
Estimated Annual Shoal Rates

Harbor Section	Shoal Rate (yd^3/yr)	Dredging Interval (yr)
Approach Channel	25,000	2
Outer Harbor	1,500	10 or more
Entrance Channel	2,000	10
Inner Harbor	1,500	> 10

Source: *Waukegan Harbor Approach Channel Dredging, Tier 1 Sediment Evaluation* (USACE, 1995).

The estimated shoaling rates indicate that the majority of the shoaling takes place in the Approach Channel. Differences between the Approach Channel and other areas in shoaling rates and sediment chemistry indicate the main source of sediment in the Approach

Channel is littoral transport of Lake Michigan sands from areas north of Waukegan Harbor (USACE, 1995). Historical studies indicate that deposition of materials in the Outer Harbor is probably the result of beach sand overtopping the north pier and passing through gaps in the sections of the pier (USACE, 1995). Based on the documented shoal rates (USACE, 1995), and assuming the propeller wash from large cargo ships results in near complete mixing of sediments in the federal navigational channel segments, it is estimated it would take over 100 years before sufficient sediment would be deposited to meet the SWAC of 0.2 ppm.

In addition, natural PCB degradation will not occur at a measurable rate or within a reasonable time period due to the persistence of PCBs. Below a certain threshold concentration (less than 50 ppm—the current range of concentration in Harbor sediments), the rate of PCB dechlorination is often very slow. PCBs strongly adsorb to soil/sediment particles, have low water solubility, are persistent in the environment (do not readily break down), and, thus, do not exhibit much migration in a given environment. Therefore, MNR is not retained for further consideration as part of the remedial alternatives for Waukegan Harbor.

3.2.3 Monitoring

Monitoring can be implemented in combination with any remedial technology as an early warning of the need for additional remedial action or to monitor the effectiveness of a completed remedial action. Monitoring may include sampling and analysis of sediment, soil, groundwater, surface water, groundwater/surface water interface, fish tissue, toxicity tests, and/or bioaccumulation tests. A sampling plan is developed in accordance with the final remedial alternative selected to ensure that remedial objectives are met.

Regardless of the technologies or combination of technologies selected for implementation at Waukegan Harbor, monitoring will likely be required; therefore, it is retained.

3.2.4 Institutional Controls

Institutional controls are administrative and/or legal restrictions placed on uses of a property or waterway (e.g., deed restrictions, access restrictions). Institutional controls can also take the form of issuance of public health advisories (e.g., fish consumption advisories).

Deed and access restrictions can be established for a contaminated property to limit its future use. For example, a property upon which a confined disposal facility (CDF) is constructed to dispose of excavated contaminated sediment may have a restriction that no construction is completed that will damage its integrity. Similarly, public waterways can be regulated through the establishment of recreational use limitations, such as swimming bans and “no wake” zones to minimize the potential for sediment disturbance. Fences can be built around the perimeter of contaminated properties to prevent entry by unauthorized persons. The Waukegan Harbor currently has “no wake” requirements; therefore, deed and access restrictions are retained for potential incorporation into alternatives.

Fish consumption advisories are intended to provide guidelines to members of the public who may eat fish with elevated contamination levels. The IDPH removed signs warning anglers not to consume fish caught in the North Harbor segment of Waukegan Harbor in February 1997, and subsequent sampling has shown that PCB concentrations in fish from the harbor are approximately equal to PCB concentrations in fish from other harbors in Lake Michigan and in the open lake. The warning had been in effect since 1993. The State of

Illinois, however, maintains a Lake Michigan Fish Consumption Advisory that warns people not to eat carp from anywhere in Lake Michigan. Restricted consumption of other species of fish from Lake Michigan is also recommended under the lake-wide advisory. In January 2008, IDPH updated the state-wide sports fish consumption advisory for Illinois waters which includes "Waukegan North Harbor of Lake Michigan" (the "Waukegan North Harbor" includes the entire Waukegan Harbor OU). Since these advisories are currently in use, this option will be kept for incorporation into alternatives.

3.2.5 Containment

In Situ Cap

Capping of sediments involves subaqueous placement of a layer of clean material over the contaminated sediment for the purposes of physically isolating the contaminated sediments, impeding contaminant flux to the environment, and/or stabilization of contaminated sediments to prevent transport and re-deposition elsewhere. Capping has been successfully implemented at numerous sites.

Development of a complete in situ capping remedial alternative involves the following steps:

- Definition of project objectives and performance standards.
- Characterization of the physical, chemical, and biological properties of the sediments, both laterally and vertically.
- Characterization of hydrodynamic conditions of the harbor, which includes bathymetry, currents, depths, waterway uses, and geotechnical conditions such as layer stratification and physical properties of foundation layers.
- Determination of the feasibility of capping, which may apply to some portions of the site and not other areas.
- Design of the cap, considering types and thickness of materials.
- Determination of appropriate equipment and methods for placement of the cap materials.
- Determination of methods to verify that the final cap design meets the standards and objectives.
- Development of a suitable long-term monitoring and management program, allowing for maintenance and repair.

Feasibility of capping is dependent upon characteristics of contaminants, physical and hydrological site conditions, and current and anticipated future uses of the waterway. Contaminant transport through the cap is dictated by contaminant type (e.g., organic or inorganic), diffusivity, and adsorption potential on the cap material. Capping is more appropriate for contaminated sediments located in areas with low erosion potential and less groundwater seepage.

Little upward transport of PCBs would be expected through a cap because they are highly adsorptive and there is little upward advective groundwater flux because of the low permeability glacial till underlying the harbor. Consideration should be given to existing and future uses of the waterway, such as recreation, navigation, or use as a water source that may preclude the implementation of an in situ cap. The Waukegan Harbor is used by cargo ships with large propellers and bow thrusters that would quickly erode typical sand caps in the navigational segments of the harbor. Caps in the navigational channel (Inner Harbor Extension, Inner Harbor, and Entrance Channel) would have to be armored to prevent erosion. Typical sand caps could be used in non-navigational areas (e.g., North Harbor and Marina) because only relatively smaller recreational boats use these harbor segments; however, the addition of gravel as a component of the cap will be needed due to the potential disturbance (i.e., bioturbation) by bottom fish-like carp.

Components of caps can include sand, clean sediment, geotextiles, gravel, stone, specialty manufactured material (such as Aquablok©), or a combination of these. If the cap is placed in a higher energy environment with exposure to propeller wash, in the case of Waukegan Harbor, an armoring layer of large armor stone will be placed as the top layer of the cap. For non-navigational areas, the cap will consist of sand overlain by gravel.

Sediment disturbance and re-suspension/mixing should be minimized when choosing placement methods and materials for capping. Delivery method selection also incorporates the relative importance of cap thickness consistency and the water depth at the capping site, which could limit delivery options if water depth is shallow.

Capping may be an appropriate technology for one or more segments in Waukegan Harbor, and will therefore be further evaluated.

Residual Sand Cover

Placement of a layer of clean sand cover material over contaminated material can be utilized to reduce the overall concentration to which biota is exposed. Cover layer placement is differentiated from the more traditional cap described above in that an allowance is made for mixing of the contaminated material with the clean material as compared to a containment cap that is designed to prevent mixing from occurring. Cover layer placement can therefore be implemented in areas exposed to extreme erosional forces where installation of a cap with a rigorous armoring layer is either impractical or prohibitively expensive.

Thickness of the residual sand cover is determined by estimating the contaminant mass within the soft sediment and then calculating the desired contaminant concentration after addition of clean material. Complete mixing is assumed. Residual cover placement is especially effective where most of the contaminant mass has already been removed.

All segments within the navigational channel at Waukegan Harbor are exposed to very strong erosional forces as a result of propeller wash from large cargo ships. However, residual cover placement could be used for most harbor segments to reduce the post-dredging residual sediment contamination. Therefore, residual sand cover placement is retained for further evaluation.

Active Cap

This remedial alternative involves placement of a layer of reactive material on top of contaminated sediment. The reactive material is intended to isolate contaminated sediments from the water phase while reducing contaminant concentrations in groundwater where an upward groundwater gradient exists through the sediment column. Several different types of reactive materials have been considered for active caps, including zero-valent iron, coke and apatite, and organo-modified clay. These are mostly still in the experimental stage with limited full-scale implementation.

Since upward groundwater movement is not a significant transport pathway for PCBs at this site, this technology will not be retained for further evaluation.

3.2.6 In Situ Treatment

In situ treatment methods are implemented without removal of contaminated sediments. The only in situ treatment technology applicable to low-level PCB-contaminated sediments, such as those in Waukegan Harbor, is fixation/stabilization.

This technology involves the immobilization of contaminants by physically binding or enclosing the sediments within a stabilized mass, or chemically treating the contaminants. Portland cement, lime, or some other additive is mixed with the sediments in situ to encapsulate the sediments and/or reduce the solubility, mobility, and toxicity of the contaminants. Potential problems with this technology include the facts that contaminant release due to erosion may still be possible, and post-treatment physical characteristics of the sediment are not very amenable to growth of aquatic organisms. The application of this technology would require dewatering of sediments; otherwise, substantial re-suspension of sediments would occur. Dewatering of the sediments would require construction of sheet pile walls within the harbor to partition areas to be dewatered. The walls would add considerable cost to the alternative while also impede commercial and recreational shipping.

Because of the potential difficulties stated above and the considerable cost for isolation and dewatering of sediment zones, in situ fixation/stabilization will not be retained for further evaluation at Waukegan Harbor.

3.2.7 Sediment Removal

Removal of contaminated sediment reduces both contaminant concentration and mass. Reduction in PCB surface concentration reduces the bioaccumulation of PCBs in fish. Sediment removal can be performed through several different methods. Removal of sediments “in the dry” can be performed by damming water to create a cell, dewatering the cell, and excavating using conventional earthmoving equipment. Sediment removal can also be achieved without dewatering using a hydraulic or mechanical dredge.

Dry Excavation

Excavation of sediments in the dry requires the installation of a water barrier around the perimeter of the area to be remediated, pumping out or otherwise diverting water from the “cell,” and excavating sediments using a backhoe or other suitable piece of equipment. Dry excavation has been successfully performed at many sites with contaminated sediments.

The most likely water barrier for the harbor would be steel sheet piling. Once the barrier is constructed, the harbor water would be pumped out. As the water level diminishes to the sediment elevation, water treatment will likely be needed before discharge back into the lake.

Depending upon the nature of the sediment and its final disposal location after excavation, the addition of lime, cement, or other stabilization reagent may be required during excavation. If the sediments are fine-grained, they may not readily drain following dewatering, and may require stabilization before they are transported out of the excavation cell.

Perimeter air monitoring for total suspended particulates (especially if a stabilizing reagent prone to producing dust is used) and PCBs will likely be required. Turbidity monitoring in the water body may also be required during any potential sediment-disturbing activity, which might include sheet pile and turbidity barrier installation and dewatering activities. If visual checks or stratigraphy change is not sufficient or appropriate to determine the extent of excavation activities, confirmation sampling is completed to verify cleanup goals have been achieved.

The main advantage of sediment removal by dry excavation is the greater likelihood that all contaminated sediment will be removed. If unanticipated or unusual conditions are present within or beneath contaminated sediments (i.e., presence of free-phase product), the dry excavation method greatly increases the likelihood of discovering these circumstances, as well as affording greater flexibility for dealing with them, as compared to sediment removal conducted without lowering the normal water level. Sediment re-suspension is not an issue as it is for other wet excavation methods such as mechanical or hydraulic dredging. Contaminated sediment spreading downstream or elsewhere within the water body does not happen with dry excavation once dewatering begins, as an inward hydraulic gradient is maintained.

Dry excavation can present some difficulties during implementation. The location of the contaminated sediments may dictate whether or not dry excavation can be used. A fairly substantial land area will be required near the dewatered cell or cells to perform a dry excavation action. Space must be available for loading/offloading and temporary storage of stabilized sediment, as well as space for support trailers, decontamination facilities, and, if necessary, water treatment facilities. If trucks are used to transport the sediment to an offsite disposal area, additional noise will be created and potential damage to roads along the haul route can occur.

An additional disadvantage of dry excavation, common to all sediment removal options, is that the aquatic environment is greatly disturbed during removal. In some cases, if all sediment is removed, placement of imported materials may be necessary to expedite the re-establishment of native aquatic species.

In the case of Waukegan Harbor, the presence of the WCP site adjacent to the harbor offers ample space to set up operations for dry excavation; however, the current property owner, City of Waukegan, is opposed to using the WCP for sediment processing.

Dry excavation will, however, require that portions of the harbor be enclosed in sheet piling for an entire season, and it will likely take two entire seasons to completely remove all sediment. Since the harbor is active for most of the year, this is not an acceptable scenario. Also, the structural integrity of the existing harbor sheet pile seawall may be compromised after the removal of the harbor water and soft sediments. Therefore, dry excavation will not be kept for further evaluation for removal of Waukegan Harbor sediments.

Hydraulic Dredging

Hydraulic dredging has been used at many sites to remove contaminated sediment. A cutter head or suction dredge is used to remove and pump sediments as a slurry through a pipeline. The hydraulic dredge is moved over the area of contaminated sediment, making adjacent overlapping passes. If deeper sediment removal is desired, additional passes are made. Typically, hydraulic dredges used for environmental remediation have global positioning system (GPS) equipment that tracks the locations and elevations that have been excavated.

One advantage to hydraulic dredging is that since the sediments are pumped in a slurry form through a pipeline from the dredge, the processing area does not necessarily have to be located adjacent to the contaminated sediment area. The slurry can be pumped directly to a location where sediment and water processing can occur. The sections of the discharge line running from the dredge can either be submerged or the dredge temporarily moved so it will not inhibit commercial boat traffic.

A considerable amount of area is required for processing sediment from hydraulic dredging. If sufficient space is available near the sediment disposal area for dewatering, no offsite trucking of sediments will be required, and impacts to the community will be lessened accordingly. Treated water can be returned to the water body using a return pipeline.

Disadvantages of hydraulic dredging include the need to treat the significant volume of water generated. Underwater obstructions such as tree stumps or other large debris are problematic for hydraulic dredging and may need to be removed using mechanical equipment. A major advantage of hydraulic dredging is the ability to use specialized equipment to remove thin layers of contaminated sediments above hard bottoms such as the clay till present in the Waukegan Harbor.

Sediment re-suspension can occur with hydraulic dredging as it will with mechanical dredging. Turbidity control barriers can be installed around the perimeter of the contaminated sediment to reduce migration of suspended sediment to other areas within the water body; however, dredging using best management practices has proved to be as effective. It should be expected that some residual contaminated sediment will remain following completion of dredging except where sediment is removed down to a hard bottom with a specially designed dredge.

Fugitive odor and dust emissions are not likely during the actual excavation activities, since the sediment is wet; these may occur as the sediment is processed for disposal.

Hydraulic dredging is retained for further evaluation.

Mechanical Dredging

Mechanical dredging differs from dry excavation in that sediments are not dewatered before removing them from the water body. Mechanical dredging can be performed using a number of possible different pieces of equipment including a clamshell bucket, dragline dredge, dipper dredge, backhoe dredge, or bucket ladder dredge. Most of these can either be land-based or placed on a barge. A mechanical dredge with a specially designed environmental clamshell bucket is the most commonly used. The clamshell bucket is suspended from a derrick on a barge or platform. Another commonly used piece of equipment is the backhoe dredge, which can be a land-based excavator placed on a barge to remove sediments. Other types of equipment are less desirable for excavation of contaminated sediments because of limited availability and/or the greater potential for sediment re-suspension. Typically, mechanical dredges used for environmental remediation have global positioning system (GPS) equipment that tracks the locations and elevations that have been excavated.

Mechanical dredging is performed either from the shore adjacent to the area of contaminated sediments, or from a barge that is moved around the area, as needed. Excavated materials are either stockpiled on shore or placed in a barge and transported to another area for offloading when the barge is full. Unless the sediments are granular and drain readily, dewatering and/or stabilization will be required before final disposal.

Mechanical dredging can be advantageous because much less water is generated than during implementation of other removal technologies, meaning reduced costs for water treatment. Fugitive odor and dust emissions are not likely during the actual excavation activities, since the sediment is wet; however, these may occur as the sediment is processed (i.e., dewatered and/or stabilized) for disposal.

Similar to dry excavation, a sizeable amount of land near the area of contaminated sediment is necessary for sediment processing, handling, and support facilities if mechanical dredging is used. Mechanical dredging also has the disadvantage of requiring multiple barges during operations including the mechanical dredge barge and multiple receiving barges.

Ample space does exist adjacent to the harbor at the WCP site for sediment processing, handling, and support facilities for the dredging operation; however, the current property owner, City of Waukegan, is opposed to using the WCP for sediment processing.

Either type of dredging can be efficient to implement depending on site-specific conditions. Hydraulic dredging is more efficient and effective in removing thin layers of sediment than mechanical dredging, especially if the sediment to be removed is underlain by a hard bottom.

The vertical profile within Slip 1 consists of a thin sediment layer (less than 1 foot thick) overlying dense clay till. Mechanical dredging will unavoidably leave dredge residuals (estimated to be 3 inches thick) on top of the till. Slip 1 is actively used by commercial vessels, which restricts the amount of the sand cover that can be placed to reduce its contribution to the overall SWAC. Additional dredging to allow for a thicker sand layer would necessitate dredging the till material, which cannot be accomplished using an environmental clamshell bucket. Hydraulic dredging without a cutterhead could be used to remove the soft sediment off the till—leaving insignificant amounts of dredge residuals. Hydraulic dredging also provides less potential for exposure to dredged sediments as they are pumped through a pipeline to a geotextile tube.

The main advantages of mechanical compared to hydraulic dredging are reduced water treatment and/or sediment dewatering costs. However, mechanically dredging thin sediment layers results in less sediment and more water in each bucket removed, which increases the amount of water that must be treated and the cost of dewatering the sediment.

Therefore, although both hydraulic and mechanical dredging could be viable technologies, only hydraulic dredging is being retained as the representative technology for sediment removal.

3.2.8 Ex Situ Treatment

Ex situ treatment methods are implemented following excavation of contaminated soils or sediments. One of the primary advantages to performing treatment is to reduce the amount of soil or sediments that require onsite consolidation or offsite disposal. Treatment can allow the sediment to be returned to its original location or to be beneficially re-used. Disadvantages to treatment are the need for additional handling and a longer implementation time than offsite disposal. Also, some of the treatment technologies do not destroy the PCBs, but rather transfer them to an alternative media that subsequently requires its own treatment.

This general response action can involve biological, chemical, thermal, or physical processes. Several different technologies were considered; however, all of these ex situ treatment technologies for sediment have been eliminated from further evaluation. The relatively low levels of PCBs in the Waukegan Harbor sediments (average of 2.2 ppm) do not justify the additional cost of sediment treatment before eventual land disposal. Ex situ treatment for the sediment will not be kept for further evaluation.

3.2.9 Sediment Dewatering

Dewatering of sediments will be necessary to some extent for any remedial action that involves sediment removal. The selected removal technology (mechanical or hydraulic dredging) will play a large role in determining the dewatering technology or technologies to be implemented.

Dewatering with Geotextile Tubes

During hydraulic dredging, large volumes of low-solids-content slurry will be generated. This slurry can be dewatered using geotextile tubes. The sediment slurry is pumped from the dredge either through a thickening process or directly into large geotextile tubes. The tubes are placed on a constructed dewatering pad to collect the water that seeps from the tubes.

Treatability testing was performed to evaluate the effectiveness of geotextile dewatering. Chemically conditioned sediments were placed in the hanging bag apparatus and allowed to dewater. Test results indicated that chemically conditioned sediments will dewater relatively quickly in the geotextile tubes; therefore, this technology is retained for further evaluation.

Mechanical Dewatering

Typically, the main processes for mechanical dewatering of sediments include belt filter and plate and frame filter presses. Mechanical dewatering may be required to increase the solids content and strength of the excavated sediment before final disposal.

Mechanical dewatering can typically achieve higher solids content (e.g., greater than 50 percent) and higher strength in dewatered material than that achieved with geotextile tube dewatering. Mechanical dewatering is typically more expensive than geotextile dewatering, but may be cost effective on an overall project basis depending on the cost of sediment transportation and disposal and the rate of dredging. With the expected transportation and offsite landfill costs and quantity and rate of dredging in Waukegan Harbor, the overall project costs using mechanical dewatering is typically greater than geotextile tube dewatering. For onsite disposal of dewatered sediments, the cost of mechanical dewatering is typically much greater than geotextile tubes. Therefore, mechanical dewatering is not retained for further evaluation.

3.2.10 Sediment Processing and Stabilization

Although ex situ treatment solely to achieve PCB concentration reduction has been ruled out as not economically justifiable, some physical stabilization of the excavated sediment beyond dewatering may be useful or necessary if sediment removal and disposal is selected as a remedial alternative. Technologies considered are particle size segregation and reagent addition.

Particle Size Segregation

Inclusion of a particle size separation step in a remedial alternative involving sediment removal may be useful if it is determined that PCB contamination is associated with a certain particle size in the sediment. For example, PCB contamination is typically found with the finer grained materials in the sediment. If a significant quantity of clean sand can be sorted out, then the sand might be disposed of at less cost than the remaining sediment or used as a beneficial fill. This process does have the disadvantage of concentrating the contamination in a smaller portion of the sediment. However, concentrating the PCBs should not be problematic for Waukegan Harbor sediments since existing PCB concentrations are relatively low (average 2.2 ppm).

Treatability testing was performed on bulk sediments from the Waukegan Harbor to determine the PCB concentration of the separated sand. Results of the tests indicated that the PCB concentration of the separated sand exceeded the 1 ppm criteria for unregulated beneficial reuse. Although sand has a low affinity to PCBs, the separation process is not absolute and some fine material will remain after completion of the separation process. This fine material that was left behind has a higher affinity to PCBs so consistent results of less than 1 ppm in sand are unlikely without further extensive processing. Particle size segregation is not retained for further consideration; however, this technology will be re-evaluated if appropriate beneficial users (e.g., daily cover for landfill) for the segregated material are identified.

Reagent Addition

The addition of a reagent to the sediment may be necessary as a step prior to final disposal. Mixing lime, cement, cement kiln dust, or similar reagent with the sediment serves to dewater and solidify it, which may be required to meet disposal criteria. For example, solid waste landfills require waste to be sufficiently dewatered to meet the paint filter test, and this can be achieved through the addition of reagent. The amount of reagent added to the sediment can be varied as field conditions dictate. If performed, reagent addition should be kept to a minimum because, in addition to the cost of the reagent, the reagent adds mass to the sediments prior to disposal, thereby increasing the landfill disposal cost.

Treatability testing was performed to determine the relative effectiveness and percent of various reagents necessary to stabilize dredged material and achieve the landfill disposal criteria (paint filter test and strength). Treatability test results indicated that when the sediment was amended with a minimum of 2.5 percent cement kiln dust (CKD) and 5 percent cement or fly ash, the amended material would pass the paint filter test. However, the sediment samples amended with 15 percent CKD, cement, or fly ash could not consistently achieve the necessary strength for unrestricted landfill disposal.

Reagent addition is not retained for further evaluation.

3.2.11 Water Treatment

Water would be generated during sediment removal, dewatering, and handling for any remedial alternative requiring sediment removal. This water would require treatment before discharge back into the harbor. Analytical results from elutriate samples collected during treatability testing were used to estimate the treatment system influent concentrations from dredging activities. Table 3 summarizes the estimated treatment system influent concentrations and the preliminary treatment system effluent limits established by IEPA for discharges back to the harbor. Contaminants of concern are typically suspended solids, PCBs, mercury, and ammonia. Standard treatment technologies for these contaminants are clarification, filtration, and activated carbon adsorption which will remove suspended solids, PCBs, and mercury to very low levels.

Ammonia, which occurs naturally in sediments as a result of decomposing organic matter, is released from the sediment pore water in the sediment slurry during dredging. The concentration of ammonia can vary greatly depending on the ammonia concentration in the sediment pore space and the slurry solids content. During performance of the treatability testing, the ammonia concentrations observed in seven elutriate samples analyzed at 8 percent solids ranged from 3.4 to 20.9 milligrams per liter (mg/L). There is no practical treatment technology available to cost-effectively treat an estimated 2,500 gallons per minute (gpm) discharge for ammonia. Instead, treatment system effluent is typically discharged through a diffuser to mix the effluent with the receiving water to reduce the ammonia concentrations below levels that would cause acute toxicity to fish. Once released into the receiving water, ammonia will readily biologically oxidize and does not bioaccumulate.

Clarification with Chemical Addition

Primary clarification is effective as an initial step in the removal of solids. Clarification is accomplished by adding chemicals to coagulate and flocculate the solids prior to settling in sedimentation tanks. The sludge collected from the clarifiers is pumped back to geotextile tubes for dewatering. Clarification is retained for further evaluation.

TABLE 3
Estimated Pretreatment System Influent

Analyte						Maxiumum[3]
Metals						
Aluminum	mg/L	NA	NA	211	5.78	382
Antimony	µg/L	NA	NA	4	3.55	5.05
Arsenic	µg/L	340	148	756	53.5	1340
Barium	µg/L	NA	NA	842	54.6	1560
Beryllium	µg/L	NA	NA	9	0.1	17

TABLE 3
Estimated Pretreatment System Influent

Analyte						Maxiumum[3]
Cadmium	µg/L	6.6	3.2	290	4.6	963
Calcium	mg/L	NA	NA	1072	44.8	2120
Chromium	µg/L	NA	NA	2144	142	4660
Cobalt	µg/L	NA	NA	115	1.1	216
Copper	µg/L	19.2	12.4	2638	23.5	6820
Iron	mg/L	NA	NA	300	5.4	560
Lead	µg/L	187.9	9.9	3689	258	6860
Magnesium	mg/L	NA	NA	620	16.1	1280
Manganese	µg/L	NA	NA	9447	3440	13400
Nickel	µg/L	623.7	69.3	356	8.3	780
Potassium	mg/L	NA	NA	34	4.04	52.3
Selenium	µg/L	NA	NA	9	1.65	21.6
Silver	µg/L	NA	NA	10	0.9	24.2
Sodium	mg/L	NA	NA	24	14.7	32.1
Thallium	µg/L	NA	NA	9	2.95	21.2
Vanadium	µg/L	NA	NA	305	6.5	556
Zinc	µg/L	159.3	159.3	5127	601	8080
Mercury	ng/L	1,700	1.3	480	75.2	1230
Hexavalent Chromium	mg/L	NA	NA	1	0.01	1.2
Trivalent Chromium	mg/L	2.375	0.1135	2	0.01	4.1
Pesticides						
Chlordane	µg/L	0.01	0.01	0.3	0.24	0.265
Dieldrin	µg/L	0.01	0.01	0.6	0.0475	2.3
Endrin	µg/L	0.086	0.036	0.1	0.0475	0.055
gamma-BHC	µg/L	0.95	0.5	0.5	0.025	2
4,4'-DDD	µg/L	0.01	0.01	0.1	0.0475	0.15
4,4'-DDE	µg/L	0.01	0.01	0.2	0.0475	0.65
4,4'-DDT	µg/L	0.01	0.01	0.2	0.0475	0.61
PCBs[1]						
Total PCBs	µg/L	0.1	0.1	72	2.8	284
Wet Chemistry						
Chloride	mg/L	NA	NA	42	40	43
Ferrous Iron	mg/L	NA	NA	7	0.1	35.5
Hardness	mg/L	NA	NA	1930	180	4000
Ammonia-Nitrogen [2]	mg/L	4.1	0.8	10	3.4	20.9
pH	ph units	NA	NA	NA	6.9	7.5
Phosphorus, Total	mg/L	5	1	12	0.02	35.2

TABLE 3
Estimated Pretreatment System Influent

Analyte						Maxiumum[3]
Total Suspended Solids	mg/L	15	NA	31062	510	66000
Total Organic Carbon	mg/L	NA	NA	104	9.10	305
Total Volatile Solids	mg/L	NA	NA	1106	96	2820

Notes:
[1] Total PCBs are the sum of the individual concentrations of the five Aroclors (1221, 1242, 1248, 1254, and 1260) detected in the harbor sediment. If the PCB concentration is reported as not detected, the PCB concentration is represented in the model as one-half of the reporting limit.
[2] Samples were collected in January and March.
[3] The analytical results from the unfiltered elutriate samples collected and testing at 8% solids were used to calculate average, minimum, and maximum concentrations.

Abbreviations:
µg/L - microgram per liter
mg/L - milligram per liter

Filtration

Filtration removes solids and, therefore, removes the contaminants that are adhered to the solids in water (e.g., PCBs and metals). Filtration for this application is typically accomplished by passing the water stream through a sand filter. Filtration is considered for further evaluation.

Activated Carbon Adsorption

Activated carbon adsorption removes certain dissolved organic contaminants (e.g., PCBs) that are not removed with the suspended solids during the clarification or filtration processes. Activated carbon can also further decrease mercury concentrations below that accomplished during sand filtration. Activated carbon adsorption is therefore retained for further evaluation.

3.2.12 Disposal

Contaminated sediments must be disposed of once they are removed. A number of options are presented below. One or more than one of these could be used.

Confined Disposal Facility (in-water)

An in-water CDF is an engineered structure for the physical containment of dredged materials. The design of each CDF is site-specific dependent on factors such as location, sediment characteristics, and sediment volume. Dikes for in-water CDFs are usually constructed in layers with heavy protective stone on the outside and progressively smaller stones to sand on the inside. Some CDFs incorporate sheet piling or slurry walls around the perimeter of the CDF zone.

CDFs have been previously used at Waukegan Harbor to dispose of contaminated sediments. A CDF was constructed within the former Slip 3 to contain the material from the 1992 dredging of the North Harbor. A portion of the North Harbor could potentially be used by dividing it lengthwise and leaving enough channel width on the west side for the passage of watercraft to Larsen Marine Service, Inc. at the north end and for commercial boat traffic on the south end. The CDF could be built up to the existing ground surface elevation. Less than 80,000 yd^3 of materials could be placed within a CDF constructed in this manner.

The limited area available for the construction of CDF does not provide sufficient capacity to accommodate the total volume of sediment to be removed to meet the RAOs. This process option for disposal of contaminated sediment is not retained for further consideration.

Waukegan Manufactured Gas and Coke Plant

Disposal of Waukegan Harbor sediments could be accomplished at the WCP site (refer to Section 1). The WCP is part of the OMC Superfund Site and the current ROD for the WCP site includes covering the contaminated soils that remain onsite at the completion of the WCP remedial action. The WCP contaminated soils have been removed and the cover has been placed. The sediments in the Waukegan Harbor have PCB concentrations of less than 50 ppm, and could be placed on the WCP, if covered. The existing cover material would need to be temporarily removed before the harbor sediments were placed, and then the cover replaced over the sediments.

Some stabilization of soft sediments would likely be necessary if these materials are placed on the WCP site. Stabilization might consist of dewatering, reagent addition, and/or mixing silty sediments with more granular sediments to improve geotechnical (i.e., shear strength and compaction) characteristics.

At this time, the City of Waukegan is opposed to placing the low-level PCBs on the WCP site because of the redevelopment plans for the site. Therefore, disposal of sediments removed from the Waukegan Harbor on the WCP plant is not retained for further consideration.

Unconfined Lake Disposal

Disposal of clean, granular dredged materials has been previously implemented in an area about 2,000 feet south of Waukegan Harbor. An unlimited amount of material meeting these criteria can be disposed of in this manner. Non-contaminated silty materials or glacial till cannot be disposed of with this option, nor can any material with detected concentrations of PCBs. The sediments addressed by this remedial action have high silt content and all segments have detected concentrations of PCBs; therefore, this option is not retained for further consideration.

OMC Plant 2 Property

Sediments could be disposed of in an engineered consolidation cell situated at the north side of the OMC Plant 2 property, between two existing containment cells. The consolidation cell would be constructed with a bottom liner and cover. The liner and cover system would be designed to contain the PCBs and would meet the SMZ requirements in 35 IAC Part 740. This disposal option for contaminated sediments is retained for further evaluation.

Subtitle D Solid Waste Landfill

Contaminated materials from Waukegan Harbor could be trucked to an offsite Subtitle D landfill(s) for disposal. Recent sampling (after the 1992 remediation of Slip 3 and the North Harbor) has shown that PCB concentrations in the harbor sediments are below 50 ppm (0 to 37 ppm) and are not classified as characteristic hazardous waste. Multiple landfills may be utilized to process the volume of dewatered sediment without causing issues with the landfill operations (i.e., delivery of sediment at a slow enough pace to effectively incorporate the sediment into the incoming municipal waste).

Disposal of these sediments at a Subtitle D solid waste landfill(s) is a viable option and is retained for further evaluation.

RCRA Hazardous Waste or TSCA Landfill

Based on recent sampling, Waukegan Harbor sediments are not classified as hazardous waste and are below the 50 ppm PCBs. Thus, the sediments may be disposed of at a Subtitle D landfill. Disposal at the more expensive RCRA hazardous waste or Toxic Substances Control Act (TSCA) landfills is not required. Therefore, disposal other than at a Subtitle D landfill is not retained for further evaluation.

3.2.13 Sediment Transport Offsite

If a remedial action involving sediment removal is undertaken, sediments will need to be transported to a final disposal location either by trucking or by pipeline (assuming it is not an in-harbor CDF located adjacent to the area being dredged).

Trucking

Trucking of sediments would be required to transport dewatered sediment to an offsite landfill for disposal. Trucks transporting contaminated sediments will be covered and the tires and exterior will be decontaminated after loading and prior to leaving the site. The traffic volume and associated noise level will increase along the haul route(s). Some additional wear to the roadways will also occur, especially if they were not originally designed to handle a large volume of heavy trucks. After the project is completed, road repairs may be needed.

Trucking of sediments for offsite disposal is retained for further consideration.

Pipeline

Sediment transport by pipeline would only be used with hydraulic dredging. The sediment slurry from the hydraulic dredge could be pumped through a pipeline all the way to a slurry processing area located at the final disposal site. One or more booster pumps may be required along the pipeline route. Also, a return pipeline would be needed to bring treated water back to the harbor for discharge.

One of the difficulties in implementing this option is selection of a pipeline route, and obtaining access easements along that route. If an offsite disposal facility is selected, a likely pipeline route would extend greater than 10 miles away and require crossing of a major highway and numerous roads. Due to the complexity and cost of installing the pipeline and the pipeline length required to reach an offsite landfill, this option is not retained for further evaluation.

SECTION 4

Alternative Descriptions

4.1 Introduction

The remedial technologies and process options that remained after screening were assembled into a range of alternatives that address the RAOs for the site. The specific details of the remedial technologies presented in each alternative are intended to serve as representative examples that will allow estimating an order-of-magnitude cost in the feasibility study. Other viable options within the same remedial technology that achieve the same objectives may be evaluated during remedial design activities for the site. The following section provides a description of dredging, sediment disposal methods, water treatment, and seawall capping because these technologies are common to all alternatives (except for the No Action alternative) and the discussion needs to be presented only once. The remainder of this section provides a detailed description of each proposed remedial alternative. Each of the technologies remaining after the technology screening (Section 3) was incorporated into at least one of the alternatives. Table 4 summarizes the developed remedial alternatives. Because only five remedial alternatives were developed, all five alternatives will be carried forward to the detailed analysis, thus eliminating the need for further screening of alternatives.

4.1.1 Dredging and Sediment Dewatering

Hydraulic dredging using a standard cutterhead is the assumed dredging method for most sediment. For thinner sediment thicknesses that must be removed to the native till, it is assumed that the cutterhead will be removed and the dredge will hydraulically "vacuum" the sediment off the till. Material will be pumped from the dredge to shore through high density polyethylene (HDPE) pipe. This pipe will be intentionally sunk to the bottom of the harbor using concrete anchors, as necessary, to allow the normal flow of boat traffic to continue during dredging. The intake pipeline to and the water supply pipeline from Waukegan Water Treatment Plant are located in the harbor, as shown in Figure 2. Before beginning the dredging activities, the Waukegan Water Treatment Plant will be contacted to confirm the exact location and depths of the pipes and to determine an appropriate protection method. Sediments near and around the pipes will be removed to the extent practicable without causing damage to the pipes or disrupting treatment operations.

Large diameter geotextile tubes will be employed for sediment dewatering. Sediment slurry will be pumped either directly into these tubes from the dredge or through a thickener prior to the tubes. A polymer and, possibly, another organic or inorganic coagulant will be added to the slurry to assist in coagulation and flocculation of fine particles. If the tube contents are to be taken offsite for disposal, the tubes will be allowed to dewater until they reach maximum solids content which is typically on the order of 30 to 45 days. After the dewatering period has elapsed, the tubes and their contents will be removed using conventional excavation equipment, loaded onto trucks, and transported to the final disposal location(s). If the sediment is being disposed of onsite, the tubes will be allowed to dewater for several months and a final cover will be placed over the tubes.

4.1.2 Sediment Disposal

Each of the alternatives described, with the exception of Alternative 1, No Action, includes disposal of dredged sediments. There are two options for the final disposal location: 1) consolidation on the northern portion of the OMC Plant 2 site in the approximate area between the existing West and East Containment Cells, or 2) offsite disposal at a RCRA Subtitle D landfill as a solid waste. It is assumed that the OMC Plant 2 building demolition activities will be completed prior to initiation of the harbor remedial action.

Onsite Disposal

If onsite disposal is implemented, sediment will be pumped to geotextile tubes placed in a consolidation cell located on the OMC Plant 2 property. The consolidation cell will include a water collection and liner system and a cover as conceptually presented in Figure 9. The consolidation cell will be designed to serve as both the base for the geotextile tubes during dewatering and as the final disposal locations for the sediments.

The base of the consolidation cell will be sloped such that water can be collected for treatment and discharged. During the dredging activities, the water weeping from the geotextile bags and precipitation on the cell will be collected and treated through a temporary system described below prior to treatment and discharge back to the harbor. The amount of weep water collected during the dredging activities while the geotextile tubes dewater will range between approximately 2,000 gpm to 2,500 gpm.

After completion of the dredging activities, the amount of water collected will decrease substantially. A cover will be placed over the geotextile tubes to complete construction of the consolidation cell. After construction of the cover, the volume of liquid that will be collected will be only that generated by infiltration through the cover. This water will be combined with the water being collected from the West and East Containment Cells that is already being treated using an onsite activated carbon treatment system. The treated water from the existing containment cells is currently discharged to Lake Michigan through the North Ditch in accordance with an existing NPDES permit. Continued operation and maintenance (O&M) cost for the treatment of additional water collected from the consolidation cell and O&M of the cover will be included in the cost estimated for the onsite disposal alternative. Institutional controls will need to be implemented to restrict future construction and other intrusive activities on the consolidation cell.

Offsite Disposal

The dredged sediment slurry will be pumped to the geotextile tubes placed in a dewatering pad situated between the two existing containment cells located on the OMC Plant 2 site. The water collection and liner system will be constructed similarly to the system used for "Onsite Consolidation" (Figure 10). The water weeping from the geotextile tubes will be collected and treated as described below.

After the sediments are sufficiently dewatered for transportation and landfill placement, the geotextile tubes and their contents will be loaded onto trucks and transported to a RCRA

TABLE 4
Remedial Alternatives Summary

General Response Actions	Remedial Technologies / Process Options	Alternative 1 No Action	Alternative 2a Environmental Dredging and Offsite Disposal	Alternative 2b Environmental Dredging and Onsite Consolidation	Alternative 3a Capping North Harbor, Slip 4, Environmental Dredging, and Offsite Disposal	Alternative 3b Capping North Harbor, Slip 4, Environmental Dredging, and Onsite Consolidation	Alternative 4a Capping North Harbor, Slip 4, Marina, and Portions of the Navigation Channel, Environmental Dredging, and Offsite Disposal	Alternative 4b Capping North Harbor, Slip 4, Marina, and Portions of the Navigation Channel, Environmental Dredging, and Onsite Consolidation	Alternative 5 Capping
No Action	None	X							
Monitoring	Sampling and analysis		X	X	X	X	X	X	X
Institutional Controls	Deed restrictions	X	X	X	X	X	X	X	X
	Fish consumption advisories	X	X	X	X	X	X	X	X
Containment	In situ sediment cap				X	X	X	X	X
					North Harbor and small portion of Slip 4 (290,300 ft^2)	North Harbor and small portion of Slip 4 (290,300 ft^2)	North Harbor, small portion of Slip 4, Marina, and portions of the navigational channel (743,100 ft^2)	North Harbor, small portion of Slip 4, Marina, and portions of the navigational channel (743,100ft^2)	All segments except Outer Harbor (1,779,700 ft^2)
	Residual sand cover		X	X	X	X	X	X	
			All Harbor Segments Except Outer Harbor and Slip 1 (1,617,900 ft^2)	All Harbor Segments Except Outer Harbor and Slip 1 (1,617,900 ft^2)	Inner Harbor, Inner Harbor Extension, Marina, Entrance Channel (1,327,600 ft^2)	Inner Harbor, Inner Harbor Extension, Marina, Entrance Channel (1,327,600 ft^2)	Inner Harbor Extension and portions of the Inner Harbor and Entrance Channel (874,800 ft^2)	Inner Harbor Extension and portions of the Inner Harbor and Entrance Channel (874,800 ft^2)	
Sediment Removal	Hydraulic dredging		X	X	X	X	X	X	
			All Harbor Segments Except Outer Harbor (195,200 cy)	All Harbor Segments Except Outer Harbor (195,200 cy)	Inner Harbor, Inner Harbor Extension, Slip 1, Marina, Entrance Channel (169,800 cy)	Inner Harbor, Inner Harbor Extension, Slip 1, Marina, Entrance Channel (169,800 cy)	Slip 1 and Portions of the Inner Harbor, Inner Harbor Extension, and Entrance Channel (111,500 cy)	Slip 1 and Portions of the Inner Harbor, Inner Harbor Extension, and Entrance Channel (111,500 cy)	
Sediment Dewatering	Geotextile tubes		X	X	X	X	X	X	
Water Treatment	Clarification with chemical addition		X	X	X	X	X	X	
	Filtration		X	X	X	X	X	X	
	Activated carbon		X	X	X	X	X	X	
Sediment Disposal	RCRA subtitle D landfill		X		X		X		
	Consolidation			X		X		X	
Sediment Transport	Truck		X		X		X		
	Slurry pipeline		X	X	X	X	X	X	

Subtitle D landfill. The size of the dewatering pad will be dependent upon several factors, including the volume of sediments to be removed and the length of time required for offsite disposal of all the sediments.

Haul roads will be constructed and maintained on the OMC Plant 2 site for the transportation of the dewatered material to the offsite landfill. The placement of the haul road will be determined to minimize impacts to property owners and to piping plover habitat on the Lake Michigan shoreline. Trucks transporting contaminated materials offsite will be covered and tires and exteriors decontaminated after loading and prior to leaving the site. After the completion of the dewatering project, the pad materials will be trucked to the offsite landfill disposal.

4.1.3 Water Treatment

Water will be generated throughout the dredging activities from the following sources:

- Dewatering pad or consolidation cell drainage from sediment
- Water treatment process backwash water and recycle streams
- Decontamination water
- Precipitation on the dewatering pad

Elutriate samples were collected during treatability testing and were used to estimate the treatment system influent concentrations from geotextile tube dewatering activities. Table 3 summarizes the estimated treatment system influent concentrations that are anticipated as a result of the geotextile tube dewatering activities.

The influent will first be pumped to a clarifier for solids removal. To facilitate the removal of solids, coagulants and flocculants will be added upstream of the clarifier. The accumulated solids in the clarifier will be removed and pumped to geotextile tubes. Effluent from the clarifier will be pumped to sand filters for additional solids removal. Effluent from the sand filters will be pumped through granular activated carbon (GAC) vessels and then discharged into the harbor through an underwater diffuser.

A portion of the effluent from the GAC vessels will be stored as a non-potable water source for treatment plant use and backwash cycles. Potable water will be used as a backup water supply. The backwash water will be pumped to storage tanks before being pumped back to the beginning of the treatment train.

The treatment system will be operated 24 hours per day, 7 days per week during dredging activities. The system will operate, as needed, during the winter months when dredging is not occurring to treat water from precipitation. The clarifier will be bypassed during the winter months when only precipitation is being processed.

After solids removal and treatment through activated carbon, the PCB concentrations will be non-detectable and will meet a PCB criterion of 0.1 micrograms per liter (μg/L) for discharge back into either Lake Michigan or Waukegan Harbor. Regular sampling will verify that this criterion is being met. The treatment system is capable of reliably reducing mercury concentrations to less than 10 nanograms per liter (ng/L—approximately equivalent to parts per trillion). However, no practical treatment system is capable of consistently treating mercury to meet the 1.3 ng/L preliminary effluent limits proposed by

IEPA. In addition, the proposed treatment system does not remove ammonia. Instead, discharge through the diffuser will decrease the ammonia concentration outside the mixing zone to less than acute toxicity levels.

4.1.4 Seawall Capping

Alternatives 2 through 4 will all result in areas where contaminated sediments will be left in place near the harbor seawalls. These sediments cannot be dredged because it may result in seawall instability or collapse. A cap will be constructed to contain the sediments and to armor these areas against propeller wash. The cap includes a sand layer, a filtering stone layer, and an armoring stone layer (Figure 11). In Alternative 5, contaminated sediments in the harbor, including the sediments near the harbor seawall, will be capped; however, restricted access to the harbor from commercial ships will eliminate the need for armoring the cap.

The seawall stability has not been confirmed and it is the responsibility of the individual owners of the property adjacent to the harbor to evaluate and protect and/or repair seawalls necessitated by the sediment remediation. USEPA will notify property owners upon approval of the preliminary design.

4.2 Alternative 1: No Action

The NCP requires that a no action alternative be included in the assembly of alternatives. Under Alternative 1, there would be no additional remedial actions conducted in the harbor to control the continued release of and exposure to contaminants. All sediments are left in place, no containment is completed, and no further action is performed. This alternative does not provide any specific response actions for environmental monitoring, controlling the migration of contaminants, or mitigating their concentrations. However, the existing Lake Michigan-wide fish consumption advisory will continue.

The current SWACs of PCBs in the individual harbor segments and the overall SWAC for Waukegan Harbor were shown in Table 1. Each individual segment, except the Outer Harbor, has a SWAC above the level deemed protective of human health of 0.2 ppm, based upon the fish consumption route of exposure. The current SWAC for the entire harbor is 1.8 ppm which significantly exceeds 0.2 ppm. Based on the documented shoal rates (USACE, 1995), and assuming the propeller wash from large cargo ships results in near complete mixing of sediments in the federal navigational channel segments, it is estimated that it would take more than 100 years before sufficient sediment would be deposited to meet the SWAC of 0.2 ppm. In addition, natural PCB degradation will not occur at a measurable rate or within a reasonable time period due to the persistence of PCBs.

4.3 Alternative 2: Environmental Dredging and Sediment Disposal

Under Alternative 2, all the required sediment remediation is accomplished using hydraulic dredging to meet the RAOs. Figure 12 shows the thickness of the sediments that have PCB concentrations greater than 1 ppm that will be removed under this alternative. The dredged materials are then dewatered and either disposed of at an offsite facility or consolidated onsite, as described previously in Section 4.1.2. The total estimated volume of sediment to be hydraulically dredged in this alternative is approximately 195,000 yd^3. Disposal of the dredged sediments at an offsite facility will be considered as Alternative 2A. Disposal of the dredged sediments in a consolidation cell on the OMC Plant will be considered as Alternative 2B.

4.3.1 Hydraulic Dredging and Sediment Dewatering

A hydraulic dredging operation at Waukegan Harbor would utilize a dredge with a standard cutter head. The sediments would be pumped from the dredge to shore through flexible, HDPE pipe that will be submerged, as necessary, using anchors to allow for normal boat traffic during dredging.

Bathymetric surveys will be conducted periodically during the work to verify that the target dredge depths are being attained. Post-dredge verification sampling will be performed to determine the amount of residual sand cover to place.

This evaluation assumes that the walkways and slips will be disassembled and removed, as necessary, to accomplish hydraulic dredging within the marina. Following sediment removal, the walkways and slips will be reconstructed. During the design, the marina as-built drawings will be examined to determine if the marina must be removed and replaced or if there are other more cost-effective sediment removal options.

The potential for sediment suspension and redeposition outside the area being dredged will be controlled during dredging activities by using best management practices. Turbidity monitoring will be conducted several times per day at established locations to determine whether dredging activities are causing readings outside the dredge area that are not excessive. Continuous real-time monitoring stations will also be used. If turbidity levels are excessive, modifications will be made to the dredging operations to reduce turbidity.

Large geotextile tubes (typically about 200 to 300 feet long and 60 or 80 feet in circumference) will be employed for sediment dewatering. They will be placed on a pad constructed at the OMC Plant 2 site to collect the water that weeps from the tubes as described in Section 4.1.2. After dewatering, the tubes will either remain in place and be covered with an engineered cover to complete the onsite consolidation cell, or the dewatered sediment will be excavated from the tubes for offsite disposal as previously described.

4.3.2 Water Treatment

Water weeping from the geotextile tubes, recycle streams, and precipitation will be collected within the granular drainage layer and pumped to a treatment system that will consist of clarification, filtration, and chemical conditioning as described in Section 4.1.3.

4.3.3 Residual Sand Cover

The residual sand cover places clean sand over the entire segment area from which contaminated sediment has been removed. This layer will serve to lower the post-dredge residual PCB concentration in the remaining sediment column. Based on experience at other similar dredging projects, residual PCBs possibly higher than the targeted 1 ppm will remain even after the sediment has been dredged to the 1 ppm PCB target elevation. These dredge residuals are the result of unavoidable sediment re-suspension and settling in the immediate work area. A residual sand cover consisting of clean sand from the Approach Channel or offsite source will be placed over the residual sediment produced from dredging activities to reduce the overall PCB concentrations to which biota are exposed. The selected placement methods will provide a controlled application that allows the capping material to gently accumulate to avoid displacement or significant mixing with underlying sediment. The final thickness of the residual sand cover will be verified using either a coring device or sediment trap.

The minimum thickness of the cover layer is based on the volume of clean material required to provide an overall harbor SWAC of 0.2 ppm after completion of the dredging and sand cover placement. The estimated thickness of the sand cover to achieve the overall harbor SWAC is presented in Table 5.

TABLE 5
Summary of Residual Sand Cover Placement Quantities and Post-Dredge SWACs

Harbor Segment	Existing Condition SWAC Total PCB Concentration (ppm)	Segment Lateral Area (ft^2)	Residual Thickness (ft)	Minimum Residual Sand Cover Thickness (ft)	Post–Remedial Action SWAC (ppm)
Larsen Marine (Slip 4)	0.37	70,300	0.25	0.5	0.00
North Harbor	2.84	286,900	0.25	0.5	0.00
Inner Harbor Extension	0.63	163,200	0.25	1	0.22
Inner Harbor	4.57	468,700	0.25	1.5	0.58
Slip 1	3.55	94,900	0.0	0	0.0
Marina	1.65	352,300	0.25	0.5	0.00
Entrance Channel	0.63	343,400	0.25	1	0.20
Outer Harbor	0.13	605,700	NA	0	0.13
Overall Harbor	**1.8**	**2,385,400**		**NA**	**0.19**

The sediments in Slip 1 will be removed to the till with a specially designed dredge. With the use of this dredge, residual contaminated sediment will not be present resulting in a final SWAC concentration in the area of 0 ppm.

Disruption to the benthic community will occur during the dredging activities. This is unavoidable, and re-establishment of aquatic organisms should occur naturally after the remedial activities have been completed.

The risk of short-term human health impacts will be minimized during remedial activities by using devices and processes designed to reduce the spread of contamination. Chances for spreading contaminated sediment beyond the remedial area will be reduced through the use of best management practices. Air monitoring will be performed during all activities with the potential to generate emissions (i.e., sediment handling and processing if reagents that may create dust are used).

Dredging of the various harbor segments will be sequenced so the harbor remains open to recreational boats and commercial ships. This alternative is implementable by limiting active dredge operations to specific segment portions and by submerging the slurry pipeline to accommodate ship and boat traffic, as needed.

Facilities for sediment dewatering and water treatment facilities need to be constructed near the harbor. The OMC Plant 2 site offers a sizeable area where such facilities could be established. The slurry and the effluent return pipeline will need to cross Sea Horse Drive during dredging and will require additional provisions for allowing unimpeded traffic flow.

Multiple Subtitle D landfills will need to be contracted to handle the possible production rates. Trucking of the sediments from the dewatering pad to landfill will cause a significant increase in heavy truck traffic along the haul route(s). Repair of some city streets along the haul route(s) may be necessary to counter the impacts of the increased heavy truck traffic.

The fish consumption advisories will be modified as appropriate as PCB concentrations in fish are reduced. The other institutional control that will remain in effect is the "No Wake" restriction for the harbor.

4.4 Alternative 3: Capping of Slip 4 and North Harbor, Environmental Dredging, and Sediment Disposal

Under Alternative 3, sediments within Slip 4 and the North Harbor segments are left in place and capped (Figure 13). The PCB-containing sediments from the remaining areas will be hydraulically dredged, dewatered, and either disposed of at an offsite facility or consolidated onsite, as described in Alternative 2. The total estimated volume of sediment to be hydraulically dredged in this alternative is approximately 170,000 yd^3. Disposal of the dredged sediments at an offsite facility will be considered Alternative 3A. Consolidation of the dredged sediments on the OMC Plant will be considered Alternative 3B. The capping of Slip 4 and the North Harbor and the environmental dredging will be the same for both Alternatives 3A and 3B. The cap will act as a barrier for chemical isolation of the sediments in order to reduce chemical bioavailability within Slip 4 and North Harbor segments. The top layer of the cap will prevent bioturbation from bottom fish (i.e., carp) from damaging the cap. As stated in the RAOs, sediment capping will be conducted such that the final elevation of the top of sediment in Slip 4 and the North Harbor will not be higher than -12 feet LWD. This will result in small quantity of sediment to be removed from Slip 4 and the North Harbor to allow for the placement of the cap.

The conceptual design of the cap is as follows: a minimum of 3 inches of sand (and a maximum of 6 inches with the subcontractor's overplacement allowance) overlain by a minimum of 4 inches of gravel (and a maximum of 7 inches with overplacement allowance) will be placed over the contaminated sediments within the North Harbor and a portion of Slip 4. A similar cap design was developed for the Lower Fox River in Wisconsin (Shaw and Anchor, 2007). Sand could be obtained from the Approach Channel (Figure 1) or obtained from an offsite source. Placement methods for the sand and gravel will minimize disturbance to the sediments and reduce sediment re-suspension and cap/sediment mixing. Selection of the delivery method will also consider the relative importance of cap thickness consistency and the water depth at the capping site, which could limit delivery options.

Large armor stone will not be necessary for the caps in Slip 4 and the North Harbor. Both Slip 4 and the North Harbor are enclosed harbor segments with no tributary flow. Therefore, erosive forces on the sediments within these segments from storm events are not a significant concern. As is the entire Waukegan Harbor, Slip 4 and the North Harbor are "No Wake" zones. In addition, Slip 4 and the North Harbor are outside the specified navigation channel; therefore, the potential for sediment erosion due to propeller wash is low.

Immediately after the completion of remedial activities, the SWAC for the entire harbor will be less than 0.2 ppm. Bathymetric surveys will be performed to monitor the physical integrity of the cap in Slip 4 and the North Harbor. Some long-term maintenance may be required for the cap, which could involve placement of additional clean materials and/or armoring to supplement and/or replace the cap where erosion occurs. Bathymetric surveys will be performed to monitor the placement and long-term integrity of the cap. Additional use restrictions including limitations on future dredging and construction in the harbor will be implemented.

4.5 Alternative 4: Capping of Slip 4, North Harbor, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Sediment Disposal

Alternative 4 consists of capping as described in Alternative 3 for a portion of Slip 4, the North Harbor, the non-navigational zone of the Marina, capping portions of the navigational channel with an armored cap, and hydraulic dredging. Hydraulic dredging will be implemented as described in Alternative 2 for all PCB-contaminated sediments that are not capped. Similar to Alternative 3, a small amount of sediment (14,200 yd^3) will need to be removed to allow for the placement of the cap. The dredged sediments will be dewatered and either disposed of at an offsite facility or consolidated onsite, as described in Alternative 2. Disposal of the dredged sediments at an offsite facility will be considered Alternative 4A. Consolidation of the dredged sediments on the OMC Plant will be considered Alternative 4B.

Under this Alternative, the non-navigational zone of the Marina will also receive a sand and gravel cap as indicated on Figure 14. There are also zones of deeper sediment within the navigational channel that will be capped using armored materials (Figure 14). The armored cap will protect contaminated sediments remaining at depth after dredging operations from propeller wash. The armored cap will be constructed as detailed on Figure 15. Figure 15 also depicts a cross section through the boundary between the Marina and the navigational channel. An armored cap will be installed in areas of the navigational channel that are hydraulically dredged to an elevation of -22.5 feet LWD but have at least 1.5 feet of contaminated sediment below that elevation. Placement of the armored cap will require sediment removal to an approximate elevation of -22.5 feet LWD to allow for the cap material and provide a 2-foot buffer zone between the top of the armor cap and the elevation required for the federal navigational channel (-18 feet LWD). The total estimated volume of sediment to be hydraulically dredged in this alternative is approximately 112,000 yd^3 including the material to be removed to allow for placement of the cap. Because of the smaller volume of material to be removed in this alternative, it is anticipated that the dredging can be completed with one 8-inch dredge.

Immediately after completion of remedial activities, the SWAC for the entire harbor will be near 0.2 ppm. Long-term monitoring of the cap will be performed to assess their physical integrity.

If the navigational channel is to be maintained at an elevation of -18 feet LWD, it will most likely be necessary to dredge again at some future date. However, the 2-foot buffer zone (Figure 15) should allow for deposition of additional sediments on top of the armored cap so that future dredging activities will not encounter cap materials.

Bathymetric surveys will be performed on a regular basis to monitor the long-term integrity of the cap. Cap maintenance, which could involve placement of additional clean materials and/or increased armoring to supplement and/or replace damaged portions of the cap, will be performed as needed. Additional use restrictions including limitations on future dredging and construction in the harbor will be implemented.

4.6 Alternative 5: Capping

Alternative 5 consists of capping all the harbor segments except the Outer Harbor. The cap will be constructed of either a layer of sand or one of sand and gravel. Some limited hydraulic dredging may be needed to allow for the installation of the cap in the marina area.

The cap will provide a barrier that isolates the contaminated sediments making them less bioavailable and prevents excessive bioturbation by bottom fish. Potential sources of the sand for the cap are either from an external source or the Approach Channel (Figure 2).

The installation of a cap throughout the harbor would result in a final sediment elevation within the non-navigational areas of shallower than -12 feet below LWD and final sediment elevations within the navigational channel of shallower than -18 feet LWD. This alternative will be viable if the harbor is deauthorized as a federal navigational channel and access to commercial ship traffic is restricted.

Bathymetric surveys will be performed on a regular basis to monitor the long-term integrity of the cap. Cap maintenance, which could involve placement of additional clean materials and/or increased armoring to supplement and/or replace damaged portions of the cap, will be performed as needed. Additional use restrictions including limitations on future dredging and construction in the harbor will be implemented.

SECTION 5

Detailed Analysis of Alternatives

5.1 Introduction

The detailed analysis presents the relevant information needed to compare the remedial alternatives for the Waukegan Harbor sediment. The detailed analysis of alternatives precedes the selection of a remedy. The selection of the remedy is conducted following the FS in the USEPA ROD.

Detailed analysis of alternatives consists of the following components:

- A detailed evaluation of each individual alternative against seven NCP evaluation criteria.
- A comparative evaluation of alternatives to one another with respect to the seven evaluation criteria.

The detailed evaluation is presented in table format and follows the alternatives as structured in Table 6. The comparative evaluation is presented in text and highlights the most important factors that distinguish alternatives from each other.

5.2 Evaluation Criteria

In accordance with the NCP, remedial actions must include the following:

- Be protective of human health and the environment.
- Attain ARARs or provide grounds for invoking a waiver of ARARs that cannot be achieved.
- Be cost effective.
- Utilize permanent solutions and alternative treatment technologies or resource-recovery technologies to the maximum extent practicable
- Satisfy the preference for treatment that reduces TMV as a principal element.

In addition, the NCP emphasizes long-term effectiveness and related considerations including:

- The long-term uncertainties associated with land disposal.
- The goals, objectives, and requirements of the Solid Waste Disposal Act.
- The persistence, toxicity, and mobility of hazardous substances and their constituents, and their propensity to bioaccumulate.
- The short- and long-term potential for adverse health effects from human exposure.

- Long-term maintenance costs.
- The potential for future remedial action costs if the selected remedial action fails.
- The potential threat to human health and the environment associated with excavation, transportation, disposal, or containment.

Provisions of the NCP require that each alternative be evaluated against nine criteria listed in 40 CFR 300.430(e)(9). These criteria were published in the March 8, 1990 *Federal Register* (55 FR 8666) to provide grounds for comparison of the relative performance of the alternatives and to identify their advantages and disadvantages. This approach is intended to provide sufficient information to adequately compare the alternatives and to select the most appropriate alternative for implementation at the site as a remedial action. The evaluation criteria include the following:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of TMV through treatment
- Short-term effectiveness
- Implementability
- Cost
- Community acceptance
- State acceptance

The criteria are divided into three groups: threshold, balancing, and modifying criteria. Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria—either they are met by a particular alternative, or that alternative is not considered acceptable. The two threshold criteria are overall protection of human health and the environment, and compliance with ARARs. If ARARs cannot be met, a waiver may be obtained in situations where one of the six exceptions listed in the NCP occur (see 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6).

Unlike the threshold criteria, the five balancing criteria weigh the trade-offs between alternatives. A low rating on one balancing criterion can be compensated by a high rating on another. The five balancing criteria include the following:

- Long-term effectiveness and permanence
- Reduction of TMV through treatment
- Short-term effectiveness
- Implementability
- Cost

The modifying criteria are community and state acceptance. These are evaluated following public comment on the proposed plan and are used to modify the selection of the recommended alternative. The remaining seven evaluation criteria, encompassing both threshold and balancing criteria, are briefly described below.

5.2.1 Threshold Criteria

To be eligible for selection, an alternative must meet the two threshold criteria described below, or in the case of ARARs, must justify that a waiver is appropriate.

Overall Protection of Human Health and the Environment

Protectiveness is the primary requirement that remedial actions must meet under CERCLA. A remedy is protective if it adequately eliminates, reduces, or controls current and potential risks posed by the site through each exposure pathway. The assessment with respect to this criterion describes how the alternative achieves and maintains protection of human health and the environment.

Compliance with ARARs

Compliance with ARARs is one of the statutory requirements of remedy selection. ARARs are cleanup standards, standards of control, and other substantive environmental statutes or regulations which are either “applicable” or “relevant and appropriate” to the CERCLA cleanup action (42 United States Code [USC] 9621(d)(2)). Applicable requirements address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. Relevant and appropriate requirements are those that while not applicable, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to environmental or technical factors at a particular site. The assessment with respect to this criterion describes how the alternative complies with ARARs or presents the rationale for waiving an ARAR. ARARs can be grouped into the following three categories:

- **Chemical-specific:** ARARs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, establish the amount or concentration of a chemical that may remain in or be discharged to the environment.
- **Location-specific:** ARARs restrict the concentration of hazardous substances or the conduct of activities solely because they are in specific locations, such as floodplains, wetlands, historic places, and sensitive ecosystems or habitats.
- **Action-specific:** ARARs include technology- or activity-based requirements that set controls, limits, or restrictions on design performance of remedial actions or management of hazardous constituents.
- The identification of ARARs was summarized in Section 2.1 and the analysis of the potential ARARs relative to the remediation of the OMC Plant 2 site are provided in Appendix A.

5.2.2 Balancing Criteria

The five criteria listed below are used to weigh the trade-offs between alternatives.

Long-Term Effectiveness and Permanence

This criterion reflects CERCLA’s emphasis on implementing remedies that will ensure protection of human health and the environment in the long term as well as in the short term. The assessment of alternatives with respect to this criterion evaluates the residual risks at a site after completing a remedial action or enacting a no action alternative and includes evaluation of the adequacy and reliability of controls.

Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the statutory preference for remedies that employ treatment of principal threat wastes as a principal element. There are no principal threat wastes for the harbor when evaluating this criterion. The assessment with respect to this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ. The criterion is specific to evaluating only how treatment reduces TMV and does not address containment actions such as capping.

Short-Term Effectiveness

This criterion addresses short-term impacts of the alternatives. The assessment with respect to this criterion examines the effectiveness of alternatives in protecting human health and the environment (that is, minimizing any risks associated with an alternative) during the construction and implementation of a remedy until the response objectives have been met.

Implementability

The assessment, with respect to this criterion, evaluates the technical and administrative feasibility of the alternative and the availability of the goods and services needed for its implementation.

Cost

Cost encompasses all engineering, construction, and O&M costs incurred over the life of the project. The assessment, with respect to this criterion, is based on the estimated present worth of the costs for each alternative. Present worth is a method of evaluating expenditures such as construction and O&M that occur over different lengths of time. This allows costs for remedial alternatives to be compared by discounting all costs to the year that the alternative is implemented. The present worth of a project represents the amount of money, which if invested in the initial year of the remedy and disbursed as needed, would be sufficient to cover all costs associated with the remedial action. As stated in the RI/FS guidance document (USEPA, 1988), these estimated costs are expected to provide an accuracy of plus 50 percent to minus 30 percent. Appendix C provides a breakdown of the cost estimate for each alternative.

The level of detail required to analyze each alternative with respect to the cost criteria depends on the nature and complexity of the site, the types of technologies and alternatives being considered, and other project-specific considerations. The analysis is conducted in sufficient detail to understand the significant aspects of each alternative and to identify the uncertainties associated with the evaluation.

The cost estimates presented for each alternative have been developed strictly for comparing the alternatives. The final costs of the project and the resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, the implementation schedule, the firm selected for final engineering design, and other variables; therefore, final project costs will vary from the cost estimates. Because of these factors, project feasibility and funding needs must be reviewed carefully before specific financial decisions are made or project budgets are established to help ensure proper project evaluation and adequate funding.

The cost estimates are order-of-magnitude estimates having an intended accuracy range of plus 50 to minus 30 percent. The range applies only to the alternatives as they are described in Section 4 and does not account for changes in the scope of the alternatives. Selection of specific technologies or processes to configure remedial alternatives is intended not to limit flexibility during remedial design, but to provide a basis for preparing cost estimates. The specific details of remedial actions and cost estimates would be refined during final design.

5.3 Detailed Analysis of Alternatives

The following alternatives were developed and described in Section 4:

- Alternative 1—No Further Action
- Alternative 2a—Environmental Dredging and Offsite Disposal
- Alternative 2b—Environmental Dredging and Onsite Consolidation
- Alternative 3a—Environmental Dredging, Capping North Harbor and Slip 4, and Offsite Disposal
- Alternative 3b —Environmental Dredging, Capping North Harbor and Slip 4, and Onsite Consolidation
- Alternative 4a—Environmental Dredging; Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel; and Offsite Disposal
- Alternative 4b—Environmental Dredging; Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel; and Onsite Consolidation
- Alternative 5—Capping
- These alternatives were evaluated in detail using the seven evaluation criteria described in Section 5.2. The detailed evaluations for these alternatives are summarized in Table 6.

5.3.1 Overall Protection of Human Health and the Environment

The RAOs for the sediment in Waukegan Harbor include the following:

- Protect human health and the environment from the adverse effects of PCBs attributable to the site.
- Remediate PCBs in sediment throughout the harbor to achieve a SWAC of 0.2 ppm by targeting a remedial action level of 1 ppm total PCBs at any single location.
- Minimize, to the extent practicable, potential human health and environmental risks that may be associated with remedial activities.
- Elevation to the top of sediment in the North Harbor or Marina will not be reduced to an elevation less than -12 feet LWD. This elevation was selected as the minimum elevation needed for recreational boaters currently using the harbor. Sediment removal solely for the purpose of recreational boating is not an objective for these two segments.

- Elevation to the top of sediment in the federal navigational channel will not be reduced to an elevation less than -18 feet LWD. Sediment removal solely for navigational purposes is not an objective for this project.
- Minimize, to the extent practicable, adverse effects on recreational and commercial shipping during remedial activities.

The No Action Alternative is not protective because it allows continued exposure by Harbor fish to the PCB-contaminated sediment, and the PCBs will continue to bioaccumulate in the fish to levels not protective of human consumption.

Alternatives 2A through 5 are considered protective of human health because dredging, capping, or some combination of dredging and capping of the sediments in the harbor will reduce the SWAC to 0.2 ppm PCBs, preventing bioaccumulation in fish at concentrations that will cause unacceptable risk to human health. Alternatives 2 through 5 all plan for the elevation requirements to be met, such as those specified for the North Harbor or Marina (no higher than -12 feet LWD) and for the current navigational channel conditions (no higher than -18 feet LWD).

5.3.2 Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements, erosion controls during dewatering and disposal/consolidation, disposal of treated water from the dewatering process, and air pollution emission requirements. Specific ARARs are listed in Appendix A. All alternatives, other than Alternative 1 (No Action), are expected to comply with ARARs with the potential exception of Alternatives 2, 3, and 4 where discharge of water to the harbor is required. Preliminary effluent limits proposed by IEPA in 2006 for the discharge of treated water to the harbor did not account for dilution with the harbor water and/or seiche influences of the harbor. Section 302.102 of 35 IAC states that "Whenever a water quality standard is more restrictive than its corresponding effluent standard, or where there is no corresponding effluent standard specified at 35 IAC 304, an opportunity shall be allowed for compliance with 35 IAC 304.105 by mixture of an effluent with its receiving waters, provided the discharger has made to comply every effort with the requirements of 35 IAC." Using guidance from 302.102, alternative dilution-based limits were calculated and presented in Appendix D. This provision does not apply to chemicals that are known to bioaccumulate, such as mercury and PCBs. A waiver for these compounds may be obtained per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.

When the dilution and seiche influences are used to estimate overall harbor water quality following the 2,500 gpm discharge, the ammonia concentration in the harbor will be below the applicable acute criteria and also below the chronic criteria. In addition, the estimated average concentration is less than the genus mean chronic value (GMCV) for fish commonly found in the harbor and would be unlikely to result in deleterious effects on these harbor fish.

TABLE 6
Detailed Evaluation of Remedial Alternatives

Alternative Description: Criterion	Alternative 1 No Action	Alternative 2a Environmental Dredging and Offsite Disposal	Alternative 2b Environmental Dredging and Onsite Consolidation	Alternative 3a Capping North Harbor, Slip 4, Environmental Dredging and Offsite Disposal	Alternative 3b Capping North Harbor, Slip 4, Environmental Dredging and Onsite Consolidation	Alternative 4a Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Offsite Disposal	Alternative 4b Capping of North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Onsite Consolidation	Alternative 5 Capping
1. <u>Overall protection of human health and the environment</u>.	Current Fish Consumption Advisories reduce, but do not prevent fish consumption. PCBs will continue to bioaccumulate in fish at unacceptable levels.	Removal of contaminated sediments to achieve a 0.2 ppm PCB surface weighted average concentration (SWAC) reduces the PCBs that bioaccumulate in fish. Offsite disposal will be protective of human health and the environment.	Removal of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish. Onsite consolidation of contaminated sediment will be protective of human health and the environment.	Removal and capping of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish. Offsite disposal of contaminated sediment will be protective of human health and the environment.	Removal and capping of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish. Onsite consolidation of contaminated sediment will be protective of human health and the environment.	Removal and capping of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish. Offsite disposal of contaminated sediment will be protective of human health and the environment.	Removal and capping of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish. Onsite consolidation of contaminated sediment will be protective of human health and the environment.	Capping of contaminated sediments to achieve a 0.2 ppm PCB SWAC reduces the PCBs that bioaccumulate in fish.
2. <u>Compliance with ARARs</u>	Not applicable: No actions implemented to require ARAR analysis.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.	All ARARs will be complied with except that surface water standards indicate that site ammonia-nitrogen and metals concentrations may exceed requirements. A waiver may be obtained for this situation per 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6), if needed.
<u>3. Long-term effectiveness and permanence</u>								
(a) Magnitude of residual risks	Unchanged from existing conditions.	An overall harbor SWAC of 0.2 ppm PCBs will be met to provide a level of residual risk within USEPA's acceptable range.		An overall harbor SWAC of 0.2 ppm PCBs will be met to provide a level of residual risk within USEPA's acceptable range.		An overall harbor SWAC of 0.2 ppm PCBs will be met to provide a level of residual risk within USEPA's acceptable range.		An overall harbor SWAC of 0.2 ppm PCBs will be met to provide a level of residual risk within USEPA's acceptable range.
(b) Adequacy and reliability of controls	Fish consumption advisories can reduce, but not eliminate consumption of fish in excess of USEPA guidelines.	Removal of contaminated sediment and placement of residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed.	Removal of contaminated sediment and placement of residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed. Onsite consolidation can adequately contain PCBs with long term maintenance of the cover. Long term collection and treatment/discharge of weep water required.	Removal of contaminated sediment and placement of a cap and residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed. Offsite landfills can adequately contain PCBs.	Removal of contaminated sediment and placement of residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. The long-term reliability of hte cap is dependant on continued monitoring and maintenance. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed. Onsite consolidation can adequately contain PCBs with long term maintenance of the cover. Long term collection and treatment/discharge of weep water required.	Removal of contaminated sediment and placement of a cap and residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed. Offsite landfills can adequately contain PCBs.	Removal of contaminated sediment and placement of residual sand cover can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed. Onsite consolidation can adequately contain PCBs with long term maintenance of the cover. Long term collection and treatment/discharge of weep water required.	Placement of a cap can reliably reduce the overall harbor SWAC to 0.2 ppm PCBs. Existing Fish Consumption Advisories will continue until they are no longer needed. No-Wake restrictions will continue to be employed.

TABLE 6
Detailed Evaluation of Remedial Alternatives

	Alternative 1	Alternative 2a	Alternative 2b	Alternative 3a	Alternative 3b	Alternative 4a	Alternative 4b	Alternative 5
Alternative Description: Criterion	**No Action**	**Environmental Dredging and Offsite Disposal**	**Environmental Dredging and Onsite Consolidation**	**Capping North Harbor, Slip 4, Environmental Dredging and Offsite Disposal**	**Capping North Harbor, Slip 4, Environmental Dredging and Onsite Consolidation**	**Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Offsite Disposal**	**Capping of North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Onsite Consolidation**	**Capping**
4. Reduction of toxicity, mobility, or volume (TMV) through treatment								
(a) Treatment process used	Not applicable.	Treatment of the PCBs in sediment is not included because of the relatively low concentrations and lack of mobility. Sediment will be dewatered, but not be otherwise treated prior to disposal. Water generated during the dewatering of the removed sediment will be treated to remove PCBs prior to discharge using filtration and granular activated carbon (GAC). The removal of solids will also reduce in the concentration of other metals. Ammonia will not be reduced by the water treatment.		Treatment of the PCBs in sediment is not included because of the relatively low concentrations and lack of mobility. Sediment will be dewatered, but not be otherwise treated prior to disposal. Water generated during the dewatering of the removed sediment will be treated to remove PCBs prior to discharge using filtration and granular activated carbon (GAC). The removal of solids will also reduce in the concentration of other metals. Ammonia will not be reduced by the water treatment.		Treatment of the PCBs in sediment is not included because of the relatively low concentrations and lack of mobility. Sediment will be dewatered, but not be otherwise treated prior to disposal. Water generated during the dewatering of the removed sediment will be treated to remove PCBs prior to discharge using filtration and granular activated carbon (GAC). The removal of solids will also reduce in the concentration of other metals. Ammonia will not be reduced by the water treatment.		Treatment of the PCBs in sediment is not included because of the relatively low concentrations and lack of mobility. A small quantity of sediment will be dewatered, but not be otherwise treated prior to disposal. Water generated during the dewatering of the removed sediment will be treated to remove PCBs prior to discharge using filtration and granular activated carbon (GAC). The removal of solids will also reduce in the concentration of other metals. Ammonia will not be reduced by the water treatment.
(b) Degree and quantity of TMV reduction	No measurable reduction of TMV.	Water treatment can effectively reduce the PCBs concentrations to non-detectable concentrations and mercury concentrations to less than 10 ng/L, and other metals to discharge standards.		Water treatment can effectively reduce the PCBs concentrations to non-detectable concentrations and mercury concentrations to less than 10 ng/L, and other metals to discharge standards.		Water treatment can effectively reduce the PCBs concentrations to non-detectable concentrations and mercury concentrations to less than 10 ng/L, and other metals to discharge standards.		The mobility of the PCBs from the sediment into the environment where they are able to bioaccumulate in fish will be greatly decreased.
(c) Irreversibility of TMV reduction	Not applicable because there is no measurable reduction in TMV.	GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	The mobility of the PCBs from the sediment into the environment can be reversed if the cap is physically removed. GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	The mobility of the PCBs from the sediment into the environment can be reversed if the cap is physically removed. GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	The mobility of the PCBs from the sediment into the environment can be reversed if the cap is physically removed. GAC will remove the PCBs from the weep water by adsorption, which is not readily reversible. The activated carbon will be either incinerated or disposed of in a landfill.	The mobility of the PCBs from the sediment into the environment can be reversed if the cap is physically removed.
(d) Type and quantity of treatment residuals	None, because no treatment is included.	Spent activated carbon and sand filter media will be generated as a result of the water treatment. All of the GAC (20 tons/vessel) and sand filter media (30 ton/vessel) will be disposed of at the end of the remediation.		Spent activated carbon and sand filter media will be generated as a result of the water treatment. All of the GAC (20 tons/vessel) and sand filter media (30 ton/vessel) will be disposed of at the end of the remediation.		Spent activated carbon and sand filter media will be generated as a result of the water treatment. All of the GAC (20 tons/vessel) and sand filter media (30 ton/vessel) will be disposed of at the end of the remediation.		Spent activated carbon and sand filter media will be generated as a result of the water treatment. All of the GAC (20 tons/vessel) and sand filter media (30 ton/vessel) will be disposed of at the end of the remediation.
(e) Statutory preference for treatment as a principal element	Preference not met because no treatment is included.	Preference not met except for water treatment.		Preference not met except for water treatment.		Preference not met except for water treatment.		Preference not met except for water treatment.

TABLE 6
Detailed Evaluation of Remedial Alternatives

	Alternative 1	Alternative 2a	Alternative 2b	Alternative 3a	Alternative 3b	Alternative 4a	Alternative 4b	Alternative 5
Alternative Description: Criterion	**No Action**	**Environmental Dredging and Offsite Disposal**	**Environmental Dredging and Onsite Consolidation**	**Capping North Harbor, Slip 4, Environmental Dredging and Offsite Disposal**	**Capping North Harbor, Slip 4, Environmental Dredging and Onsite Consolidation**	**Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Offsite Disposal**	**Capping of North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Onsite Consolidation**	**Capping**
5. Short-term effectiveness								
(a) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Dredging of sediment may result in potential exposure of workers via direct contact. Offsite transport of sediment may result in exposure via direct contact or air. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of residual sand cover to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of consolidation cell cover and residual sand cover to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Offsite transport of sediment may result in exposure via direct contact or air. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of residual sand cover or cap to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of consolidation cell cover, residual sand cover, and cap to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Offsite transport of sediment may result in exposure via direct contact or air. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of residual sand cover and cap to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of consolidation cell cover, residual sand cover, and cap to follow appropriate construction procedures for safety.	Dredging of sediment may result in potential exposure of workers via direct contact. Offsite transport of sediment may result in exposure via direct contact or air. Proper health and safety procedures such as use of appropriate PPE, truck decon, and air monitoring procedures can reduce impacts to workers. Placement of cap to follow appropriate construction procedures for safety.
(b) Protection of community during remedial action	No remedial action; therefore, not applicable.	Limited risks to the community during dredging and offsite disposal due to limited traffic access for trucks hauling impacted material. Dust emissions will be controlled with air monitoring and engineering methods to protect the community. Decontamination of trucks used to transport contaminated materials will occur to prevent the spread of contamination along haul routes.	Limited risks to the community during dredging and onsite consolidation due to limited access to operational areas. Dust not likely using slurry transport to final onsite consolidation cell destination, but dust emissions will be monitored.	Limited risks to the community during dredging and offsite disposal due to limited traffic access for trucks hauling impacted material. Dust emissions will be controlled with air monitoring and engineering methods to protect the community. Decontamination of trucks used to transport contaminated materials will occur to prevent the spread of contamination along haul routes.	Limited risks to the community during dredging and onsite consolidation due to limited access to operational areas. Dust not likely using slurry transport to final onsite consolidation cell destination, but dust emissions will be monitored.	Limited risks to the community during dredging and offsite disposal due to limited traffic access for trucks hauling impacted material. Dust emissions will be controlled with air monitoring and engineering methods to protect the community. Decontamination of trucks used to transport contaminated materials will occur to prevent the spread of contamination along haul routes.	Limited risks to the community during dredging and onsite consolidation due to limited access to operational areas. Dust not likely using slurry transport to final onsite consolidation cell destination, but dust emissions will be monitored.	Limited risks to the community during capping due to limited access to operational areas.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Environmental impacts likely limited to disturbance and resuspension of sediment contamination into the water column. Short-term impacts from the discharge of treated weep water back to the harbor which may have levels of ammonia and metals (e.g. mercury) above the Great Lakes Water Quality criteria		Environmental impacts likely limited to disturbance and resuspension of sediment contamination into the water column. Short-term impacts from the discharge of treated weep water back to the harbor which may have levels of ammonia and metals (e.g. mercury) above the Great Lakes Water Quality criteria		Environmental impacts likely limited to disturbance and resuspension of sediment contamination into the water column. Short-term impacts from the discharge of treated weep water back to the harbor which may have levels of ammonia and metals (e.g. mercury) above the Great Lakes Water Quality criteria		Environmental impacts likely limited to disturbance and resuspension of sediment contamination into the water column. Short-term impacts from the discharge of treated weep water back to the harbor which may have levels of ammonia and metals (e.g. mercury) above the Great Lakes Water Quality criteria
(d) Time until RAOs are achieved	Based on current shoal rates, greater than 100 years to meet a surface-weighted average PCB concentration of 0.2 ppm.	The surface weighted average concentrations (SWAC) for the entire harbor will be less than 0.2 ppm immediately following the sediment removal and placement of a residual sand cover. The remediation of the contaminated sediments should result in a decrease in the fish tissue PCB concentrations over time.		The surface weighted average concentrations (SWAC) for the entire harbor will be less than 0.2 ppm immediately following the sediment removal and placement of a residual sand cover and cap. The remediation of the contaminated sediments should result in a decrease in the fish tissue PCB concentrations over time.		The surface weighted average concentrations (SWAC) for the entire harbor will be less than 0.2 ppm immediately following the sediment removal and placement of a residual sand cover and cap. The remediation of the contaminated sediments should result in a decrease in the fish tissue PCB concentrations over time.		Placement of a cap will immediately accomplish a surface weighted average concentration (SWAC) of 0.2 ppm. The remediation of the contaminated sediments should result in a decrease in the fish tissue PCB concentrations over time.

TABLE 6
Detailed Evaluation of Remedial Alternatives

Alternative Description: Criterion	Alternative 1 No Action	Alternative 2a Environmental Dredging and Offsite Disposal	Alternative 2b Environmental Dredging and Onsite Consolidation	Alternative 3a Capping North Harbor, Slip 4, Environmental Dredging and Offsite Disposal	Alternative 3b Capping North Harbor, Slip 4, Environmental Dredging and Onsite Consolidation	Alternative 4a Capping North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Offsite Disposal	Alternative 4b Capping of North Harbor, Slip 4, Marina, and Portions of the Navigational Channel, Environmental Dredging, and Onsite Consolidation	Alternative 5 Capping
6.Implementability								
(a) Technical feasibility	No impediments.	No impediments.		No impediments.		No impediments.		No impediments.
(b) Administrative feasibility	No impediments.	No impediments. Coordination with local industry during dredging to limit impact to commercial ship traffic.	No Impediments. Coordination with the City of Waukegan required to finalize onsite consolidation cell configuration and footprint. Coordination with local industry during dredging to limit impact to commercial ship traffic.	No impediments. Coordination with local industry during dredging to limit impact to commercial ship traffic.	No Impediments. Coordination with the City of Waukegan required to finalize onsite consolidation cell configuration and footprint. Coordination with local industry during dredging to limit impact to commercial ship traffic.	No impediments. Coordination with local industry during dredging to limit impact to commercial ship traffic.	No Impediments. Coordination with the City of Waukegan required to finalize onsite consolidation cell configuration and footprint. Coordination with local industry during dredging to limit impact to commercial ship traffic.	Alternative only viable if the de-authorization of the harbor is achieved. If de-authorization of the harbor is not achieved, the cap in the navigational channel would be disturbed by the commercial ship traffic and not provide the needed isolation of contamination sediments.
(c) Availability of services and materials	No impediments.	The rate at which a landfill can accept the dewatered sediments will be based on the final characteristics of the sediments and will be the primary factor determining the rate at which dewatered sediment will be transported offsite.	No impediments.	The rate at which a landfill can accept the dewatered sediments will be based on the final characteristics of the sediments and will be the primary factor determining the rate at which dewatered sediment will be transported offsite.	No impediments.	The rate at which a landfill can accept the dewatered sediments will be based on the final characteristics of the sediments and will be the primary factor determining the rate at which dewatered sediment will be transported offsite.	No impediments.	No impediments.
7. Total Cost	$0	$48,400,000	$34,900,000	$44,300,000	$33,000,000	$29,900,000	$24,400,000	$9,600,000

5.3.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of alternatives is evaluated in terms of the magnitude of residual risk and the adequacy and reliability of controls. There would be no changes to the current risk levels for Alternative 1 (No Action) as the PCB-impacted sediment would still be bioavailable to the harbor fish. The risk evaluations indicated that if the PCB concentrations in the sediment were decreased to a SWAC of 0.2 ppm, that the estimated lifetime cancer risk would be about 1 x 10^{-5} and the non-carcinogenic risk (hazard quotient) would be 1 for unrestricted 225 meals per year case scenario. The residual risk is identical for Alternatives 2A through 5 because they all will decrease the overall SWAC in sediment to 0.2 mg/kg total PCBs, which will be protective of high consumers of fish.

The adequacy and reliability of the dredging (Alternatives 2, 3, and 4) and capping (Alternatives 3, 4, and 5) methods are considered similar to each other because, in each case, the PCBs in the sediment would be no longer be available for fish to bioaccumulate. Both dredging and capping are reliable technologies used at multiple sites and varying site conditions. If capping is implemented, total PCB concentrations greater than 1 ppm will remain beneath the capped areas. Dredging may also result in very thin residual sediment layer having total PCB concentrations greater than 1 ppm, which will be addressed using a residual sand layer. Dredging and capping will result in the surface layer that has total PCB concentrations meeting the SWAC goal and limits the bioavailability of the PCBs to the harbor fish; therefore, are equally effective and protective in the long term.

Alternatives 2a and 2b are considered slightly more reliable because they do not require long-term maintenance and monitoring of the capped harbor sediment. The onsite consolidation of sediments (Alternatives 2b, 3b, and 4b) require long-term collection and treatment of the weep water that is drained from the sediments and long-term maintenance of the consolidation cell cover.

The long-term effectiveness and permanence of Alternative 5 is dependant on whether the harbor is de-federalized and access to deep draft commercial ship traffic is restricted. Alternative 5 will result in harbor segments having final depths less than the federal authorized depth and would impede future harbor maintenance by the USACE. The shallower depth in the navigational channel would prevent the local industries use of deep draft vessels.

5.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment

None of the alternatives include PCB treatment of the sediment matrix. Because of the relatively low levels of PCBs (average of 2.2 ppm) in the sediments and the limited mobility of PCBs, additional treatment of the sediments cannot be cost-effectively accomplished before land disposal. Under Alternative 2 through 4, there is some minimal treatment of the water collected in the dewatering system. The water will be collected and treated using GAC, but the spent GAC will either be placed in a landfill or incinerated.

5.3.5 Short-Term Effectiveness

There are no additional risks associated with the implementation of Alternative 1 because no remedial action would be taken. Alternatives 2 through 4 would have similar impact with respect to the protection of workers or the environment—sediment will be disturbed, removed, and handled, mostly using properly designed equipment that may not require direct contact, but direct contact to workers is possible during operations. The higher volume of sediment removed and managed, either disposed offsite or consolidated onsite, the higher the chance for worker risk. Alternative 5 would require no direct contact to PCB-contaminated sediment. In Alternatives 2 through 5, workers would be exposed to normal construction-related dangers during the execution of work.

The loading and offsite transport of sediment (Alternatives 2a, 3a, and 4a) may result in greater potential for exposure to the community via air or direct contact than consolidation onsite. However, dust emissions can be controlled using standard engineering controls, and trucks would be covered and decontaminated prior to leaving the site. No health-related impacts to the community are anticipated with implementation of Alternative 5.

Short-term environmental impacts are likely limited to the disturbance and resuspension of sediment contamination into the water column during dredging or capping operations. The resuspension of sediments during these activities may result in a short-term release of PCBs into the water column.

There may also be short-term impacts from the discharge of treated water back into the harbor for Alternatives 2, 3, and 4. The treatment system will not remove ammonia prior to discharging water back to the harbor. When dilution and seiche influences are considered for the harbor with a discharge flow of 2,500 gpm, the average harbor ammonia concentration resulting from the discharge during the dredging will be below the applicable acute and the chronic criteria. In addition, the estimated average ammonia concentration is less than the GMCV for fish commonly found in the harbor and would be unlikely to result in deleterious effects on the fish in the harbor. The higher the volume of dredged material, the more water and associated ammonia that would be collected, treated, and discharged to the harbor. Alternative 5 requires a significantly lower volume of surface water discharge to the harbor.

The treatment system will reliably reduce metal concentrations, including mercury, through the removal of solids. However, no practical treatment system is capable of consistently treating mercury to meet the 1.3 ng/L preliminary effluent limits proposed by IEPA. Estimated mercury discharge concentrations are greater than the proposed mercury limit, but are well below the proposed acute not-to-exceed limit. In addition, the short duration of the discharge will result in a small overall mass of mercury discharged to the harbor.

Based on current shoal rates, more than 100 years would be required under the No Action Alternative (No. 1) to meet a surface-weighted average total PCB concentration of 0.2 ppm. Immediately after implementation of Alternatives 2, 3, 4, or 5, the SWAC for the entire harbor will be less than 0.2 ppm. The remediation of the contaminated sediments should result in a decrease in fish tissue PCB concentrations over time.

In summary, the short-term impacts on the workers and community during the remedial actions can be mitigated by engineering controls. The short-term impacts of the remedial action on the environment include contributing PCBs to the water column from the resuspension of sediments and the discharge of the ammonia and metals to the harbor from the treatment system. The short duration of the dredging and discharge activities results in a small overall mass loading to the harbor, but the removal of the sediments provides a significant overall benefit to the future environmental condition of the harbor.

5.3.6 Implementability

There are no technical impediments to implementing any of the five alternatives. All of the alternatives can be implemented with readily available materials and methods. Implementation of Alternatives 2, 3, 4, and 5 will require coordination with the local industry to limit impacts to incoming ship and boat traffic.

The main administrative challenge to offsite disposal (Alternatives 2a, 3a, and 4a) will be maximizing the amount of material that can be transported offsite daily without exceeding the rate at which the landfill can process the material. This challenge can be reduced by transporting the sediments to multiple landfills. The final dewatered sediment volume and characteristics, along with the proposed rate of offsite transfer, will affect an offsite disposal facility's ability to accept all/a portion of the sediments.

The main technical challenge for the Alternatives 2b, 3b, and 4b is design and preparation of the onsite consolidation area. The currently existing onsite containment cells affect the location of the consolidation cell and the structural ability to place materials. In addition, the onsite consolidation of dredged sediments will also require coordination with the City of Waukegan to finalize the onsite consolidation cell configuration and footprint. Onsite consolidation would require ongoing management of water discharge and maintenance of the cover.

The implementation of Alternative 5 is dependant on the de-federalizing the harbor and restricting access to the deep draft commercial vessels. Without the de-federalizing the harbor, the cap in the navigational channel would be disturbed by the deep draft vessels entering the harbor and would re-expose the contaminated sediment. In addition, the placement of a cap would impede the USACE's ability to maintain the navigational channel.

5.3.7 Cost

An overview of the cost analysis performed for this FS and the detailed breakdowns for each of the alternatives are presented in Appendix C, with the total costs summarized in Table 7.

- The lowest cost alternative is Alternative 5; however, this alternative would require the harbor to be de-federalized and would negatively impact the existing industry on the harbor. The highest cost alternative is Alternative 2a. One of the largest cost items is the transportation and disposal of taking the dewatered sediments to an offsite landfill. A significant reduction in cost is realized if the sediments can be consolidated onsite.
- Another potential cost savings is reuse of sand that could be separated before placing the dredge material into the geotextile tubes. At this time, this technology has not been included because an entity to take the material for beneficial reuse could not been identified. One potential option for the separated sand may be to use it for the sloping of the consolidation cell prior to installation of the cover. If the geotechnical characteristics of the material meet the design specifications, the estimated cost for Alternatives 2b and 3b could be reduced by approximately $400,000. The savings would be less than $100,000 for Alternative 4b because of the smaller volume of material needed for construction of the consolidation cell. If a reduced disposal rate for the

removed sand could be negotiated with the offsite landfill; there could be a cost savings to Alternative 2a, 3a, and 4a.

Per the statement of work, this FS evaluates alternatives for environmental dredging and navigational dredge depths of -18 feet LWD for the Inner Harbor, Inner Harbor Extension, and Entrance Channel. The cost estimate for the additional incremental dredging necessary to meet the full Congressionally-authorized navigational dredge depths of -23 ft LWD is summarized in Table 8 and presented in Appendix E.

TABLE 7
Summary of Detailed Cost Estimates

Capital Item	Alternative 1 - No Action	Alternative 2a - Environmental Dredging and Offsite Disposal	Alternative 2b - Environmental Dredging and Onsite Consolidation	Alternative 3a - Capping of North Harbor and Slip 4, Environmental Dredging and Offsite Disposal	Alternative 3b - Capping of North Harbor and Slip 4, Environmental Dredging and Onsite Consolidation	Alternative 4a - Capping of North Harbor, Slip 4, Marina, and Portions for the Navigational Channel, Environmental Dredging and Offsite Disposal	Alternative 4b - Capping of North Harbor, Slip 4, Marina, and Portions for the Navigational Channel, Environmental Dredging and Onsite Consolidation	Alternative 5 - Capping
Pre-Construction Submittals	$ -	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 71,000
Setup of Temporary Facilities	$ -	$ 771,418	$ 549,330	$ 740,704	$ 527,513	$ 705,078	$ 538,050	$ 454,000
Temporary Dewatering Pad Construction	$ -	$ 2,624,253	$ -	$ 2,381,516	$ -	$ 1,853,281	$ -	$ 275,000
Consolidation Cell Construction	$ -	$ -	$ 3,478,465	$ -	$ 3,303,201	$ -	$ 3,195,593	$ -
Water Treatment Construction	$ -	$ 4,351,023	$ 4,351,023	$ 4,351,023	$ 4,351,023	$ 2,391,528	$ 2,391,528	$ 171,000
Dewatering Operation	$ -	$ 4,394,312	$ 4,124,812	$ 3,883,253	$ 3,613,753	$ 3,198,671	$ 2,966,656	$ 305,848
Marina Removal	$ -	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000
Sediment Removal	$ -	$ 5,562,825	$ 5,562,825	$ 4,850,620	$ 4,850,620	$ 1,549,933	$ 1,549,933	$ 396,667
In Situ Cap/Cover Placement	$ -	$ 2,707,433	$ 2,707,433	$ 2,663,813	$ 2,663,813	$ 3,416,987	$ 3,416,987	$ 3,101,421
Transportation and Disposal Offsite	$ -	$ 9,157,606	$ 61,520	$ 8,013,180	$ 61,520	$ 4,575,866	$ 55,760	$ 149,415
Long-term Treatment System	$ -	$ -	$ 100,000	$ -	$ 100,000	$ -	$ 100,000	$ -
Surface Restoration	$ -	$ 49,587	$ 21,600	$ 49,587	$ 21,600	$ 49,587	$ 21,600	$ 14,400
Demobilize	$ -	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000
SUBTOTAL ESTIMATED COST	**$ -**	**$ 30,814,456**	**$ 22,153,006**	**$ 28,129,696**	**$ 20,689,043**	**$ 18,936,930**	**$ 15,432,107**	**$ 6,008,751**
Payment/Performance Bonds and Insurance (4%)	$ -	$ 1,232,578	$ 886,120	$ 1,125,188	$ 827,562	$ 757,477	$ 617,284	$ 240,350
Contractor G&A (12.7%)	$ -	$ 4,069,973	$ 2,925,969	$ 3,715,370	$ 2,732,609	$ 2,501,190	$ 2,038,273	$ 793,636
Contractor Fee (5%)	$ -	$ 1,805,850	$ 1,298,255	$ 1,648,513	$ 1,212,461	$ 1,109,780	$ 904,383	$ 352,137
Contractor Professional/Technical Services	$ -	$ 1,851,361	$ 1,276,377	$ 1,716,912	$ 1,530,895	$ 1,274,756	$ 878,135	$ 477,219
Program Management Oversight (2.5%)	$ -	$ 994,355	$ 713,493	$ 908,392	$ 674,814	$ 614,503	$ 496,755	$ 196,802
Contingency (20%)	$ -	$ 7,584,571	$ 5,452,670	$ 6,923,753	$ 5,092,335	$ 4,661,075	$ 3,798,409	$ 1,478,975
Long-term Operation & Maintenance		$ -	$ 156,550	$ 86,308	$ 242,858	$ 86,308	$ 242,858	$ 86,308
TOTAL ESTIMATED COST[1]	**$ -**	**$ 48,400,000**	**$ 34,900,000**	**$ 44,300,000**	**$ 33,000,000**	**$ 29,900,000**	**$ 24,400,000**	**$ 9,600,000**

Notes
1) Based on 2008 dollars
2) All numbers rounded to near $100,000

TABLE 8

Summary of Detailed Cost Estimates for Additional Sediment to 23 feet LWD

Capital Item	Alternative 1 - No Action	Alternative 2a - Environmental Dredging and Offsite Disposal	Alternative 2b - Environmental Dredging and Onsite Consolidation	Alternative 3a - Capping of North Harbor and Slip 4, Environmental Dredging and Offsite Disposal	Alternative 3b - Capping of North Harbor and Slip 4, Environmental Dredging and Onsite Consolidation	Alternative 4a - Capping of North Harbor, Slip 4, Marina, and Portions for the Navigational Channel, Environmental Dredging and Offsite Disposal	Alternative 4b - Capping of North Harbor, Slip 4, Marina, and Portions for the Navigational Channel, Environmental Dredging and Onsite Consolidation	Alternative 5 - Capping
Pre-Construction Submittals	$ -	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 126,000	$ 71,000
Setup of Temporary Facilities	$ -	$ 802,794	$ 572,405	$ 772,081	$ 550,588	$ 724,506	$ 560,456	$ 454,000
Temporary Dewatering Pad Construction	$ -	$ 2,624,253	$ -	$ 2,381,516	$ -	$ 1,853,281	$ -	$ 275,000
Consolidation Cell Construction	$ -	$ -	$ 3,478,465	$ -	$ 3,303,201	$ -	$ 3,195,593	$ -
Water Treatment Construction	$ -	$ 5,166,414	$ 5,166,414	$ 5,166,414	$ 5,166,414	$ 2,826,562	$ 2,826,562	$ 171,000
Dewatering Operation	$ -	$ 4,953,395	$ 4,683,895	$ 4,442,337	$ 4,172,837	$ 3,887,230	$ 3,719,730	$ 305,848
Marina Removal	$ -	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000	$ 800,000
Sediment Removal	$ -	$ 6,316,102	$ 6,316,102	$ 5,603,898	$ 5,603,898	$ 1,880,528	$ 1,880,528	$ 396,667
In Situ Cap/Cover Placement	$ -	$ 2,707,433	$ 2,707,433	$ 2,663,813	$ 2,663,813	$ 3,416,987	$ 3,416,987	$ 3,101,421
Transportation and Disposal Offsite	$ -	$ 10,143,840	$ 61,520	$ 8,999,414	$ 61,520	$ 5,562,101	$ 55,760	$ 149,415
Long-term Treatment System	$ -	$ -	$ 100,000	$ -	$ 100,000	$ -	$ 100,000	$ -
Surface Restoration	$ -	$ 49,587	$ 21,600	$ 49,587	$ 21,600	$ 49,587	$ 21,600	$ 14,400
Demobilize	$ -	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000	$ 270,000
SUBTOTAL ESTIMATED COST	**$ -**	**$ 33,959,819**	**$ 24,303,834**	**$ 31,275,060**	**$ 22,839,871**	**$ 21,396,781**	**$ 16,973,215**	**$ 6,008,751**
Payment/Performance Bonds and Insurance (4%)	$ -	$ 1,358,393	$ 972,153	$ 1,251,002	$ 913,595	$ 855,871	$ 678,929	$ 240,350
Contractor G&A (12.7%)	$ -	$ 4,485,413	$ 3,210,050	$ 4,130,810	$ 3,016,690	$ 2,826,087	$ 2,241,822	$ 793,636
Contractor Fee (5%)	$ -	$ 1,990,181	$ 1,424,302	$ 1,832,844	$ 1,338,508	$ 1,253,937	$ 994,698	$ 352,137
Contractor Professional/Technical Services	$ -	$ 1,986,500	$ 1,368,100	$ 1,833,498	$ 1,622,618	$ 1,400,771	$ 981,182	$ 477,219
Program Management Oversight (2.5%)	$ -	$ 1,094,508	$ 781,961	$ 1,008,080	$ 743,282	$ 693,336	$ 546,746	$ 196,802
Contingency (20%)	$ -	$ 8,358,761	$ 5,982,068	$ 7,697,943	$ 5,621,733	$ 5,266,535	$ 4,177,733	$ 1,478,975
Long-term Operation & Maintenance		$ -	$ 156,550	$ 86,308	$ 242,858	$ 86,308	$ 242,858	$ 86,308
TOTAL ESTIMATED COST[1]	**$ -**	**$ 53,200,000**	**$ 38,200,000**	**$ 49,100,000**	**$ 36,300,000**	**$ 33,800,000**	**$ 26,800,000**	**$ 9,600,000**

Notes

1) Based on 2008 dollars

2) All numbers rounded to near $100,000

SECTION 6

References

CH2M HILL. 1995. *Technical Memorandum: Waukegan Manufactured Gas and Coke Plant Site, Waukegan, Illinois. Ecological Risk Assessment*. November 27, 1995.

CH2M HILL. 2005. *Data Evaluation Summary Report*, *Waukegan Harbor Area of Concern, Waukegan, Illinois.*

CH2M HILL. 2007. *Work Plan. OMC Waukegan Harbor Site, Waukegan, Illinois.* Remedial Investigation/Feasibility Study. December 5.

CH2M HILL. 2006. *Risk Evaluation for Development of a PCB Sediment Cleanup Level, Waukegan Harbor Area of Concern*, *Waukegan, Illinois*. July.

Clark, Milt. 2003. *Risk Evaluation of Waukegan Harbor Sediments*. Memorandum to Matthew Ohl/USEPA. July 9.

Clark Milt. 2008. *Evaluation of Human Health Risks/PCB Cleanup Levels at Waukegan Harbor*. Memorandum to Kevin Adler/USEPA. September 10.

Shaw and Anchor. 2007. *Lower Fox River Operable Units 2-5: 30 Percent Design*. November.

University of Illinois at Chicago, 2005. *Illinois Beach State Park (IBSP): Determination of Asbestos Contamination in Beach Nourishment Sand. Interim Report of Findings.* June 6, 2005.

USACE. 1995. *Waukegan Approach Channel Dredging, Tier 1 Sediment Evaluation*.

USACE. 2006. *Human Health Risk Assessment; Potential Asbestos Risks in Beneficial use of Dredged Material from Waukegan Outer Harbor*, Waukegan, Illinois. Prepared by USACE Buffalo District, November 2006.

USEPA. 1988. *Remedial Investigation/Feasibility Study Guidance Document*.

USEPA. 1999. USEPA. 1999b. *Evaluation of Toxicity and Bioaccumulation of Contaminants in Sediments from Waukegan Harbor, Illinois*. October.

USEPA. 2002. *Second Five-Year Review Report for Outboard Marine Corporation Superfund Site, Waukegan, Lake County IL*. 23pp. September.

USEPA. 2007. *Third Five-Year Review Report, Outboard Marine Corporation Superfund Site, Waukegan, Illinois*. September.

Figures

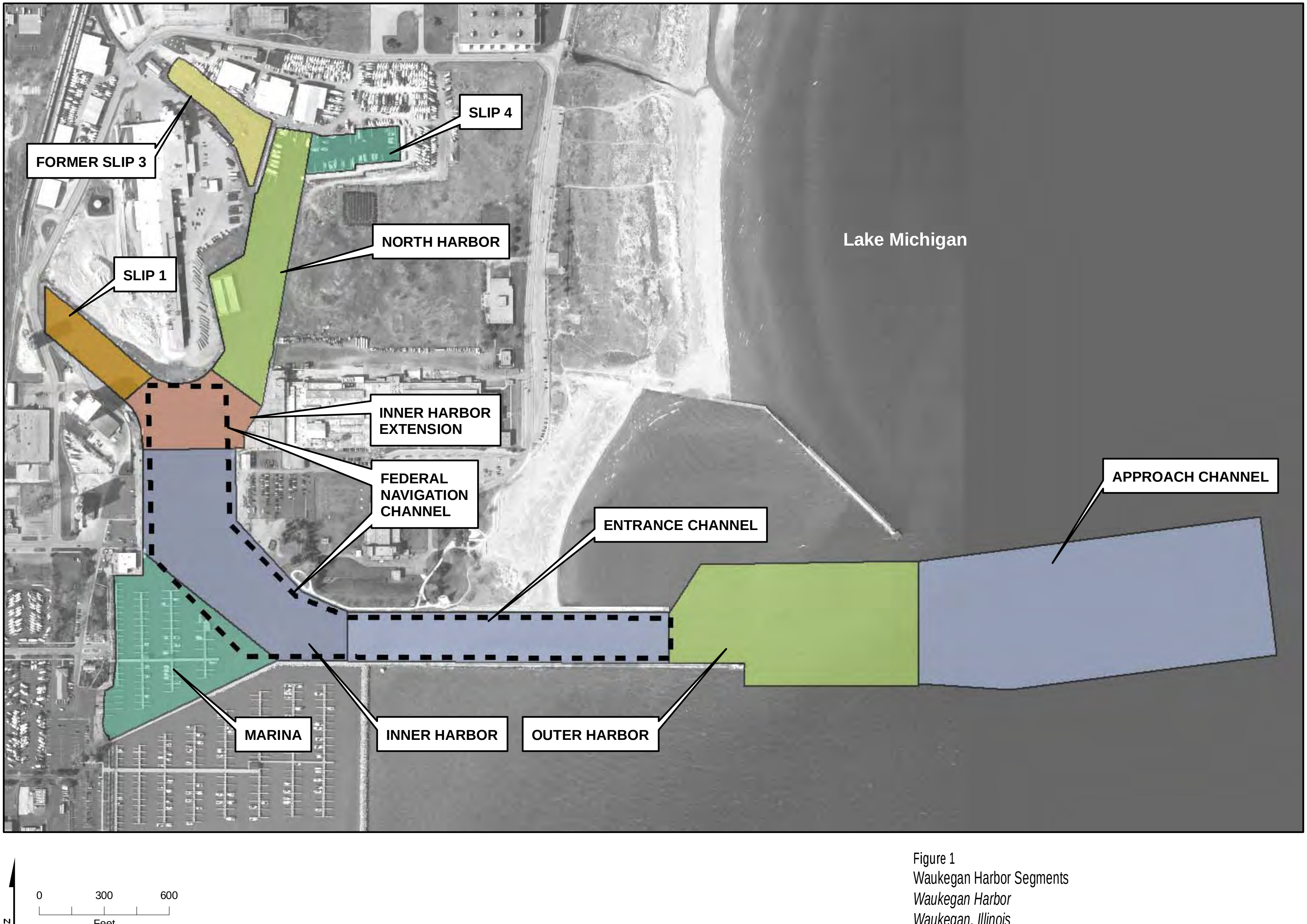
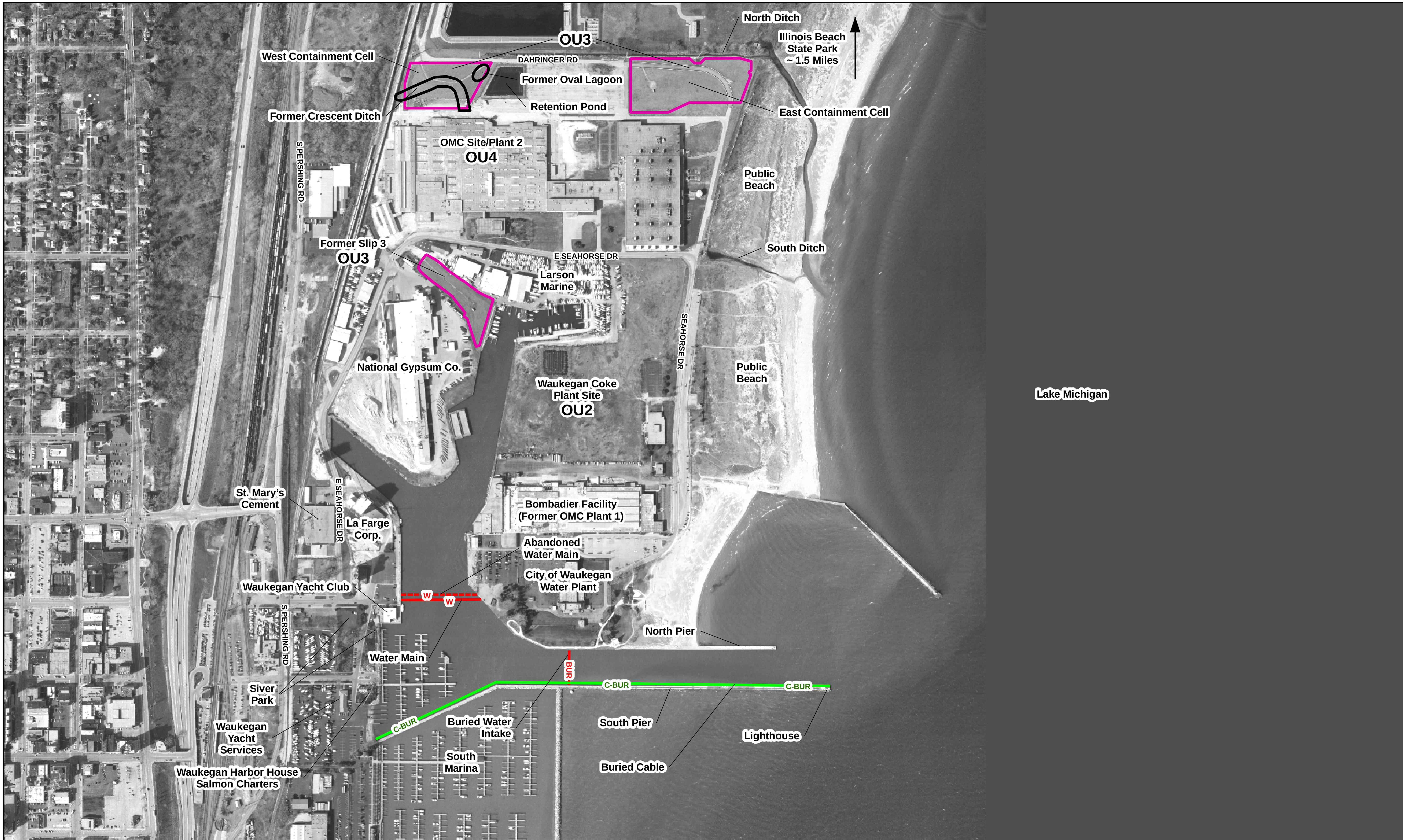


Figure 1
Waukegan Harbor Segments
Waukegan Harbor
Waukegan, Illinois

CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE01_WAUKEGAN_HARBOR_SEGMENTS.MXD 3/28/2008 14:39:31



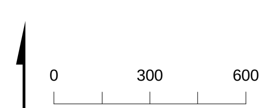


Figure 2
Site Vicinity Facilities
Waukegan Harbor
Waukegan, Illinois

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE02_WAUKEGAN_HARBOR_SITEVICINITYFACILITY.MXD 2/13/2008 15:43:52

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Figure 3
Coarse Sediment Distribution
Waukegan Harbor
Waukegan, Illinois

CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE03_WAUKEGAN_HARBOR_COURSE_SEDIMENT_DISTRIBUTION.MXD 2/13/2008 14:46:38

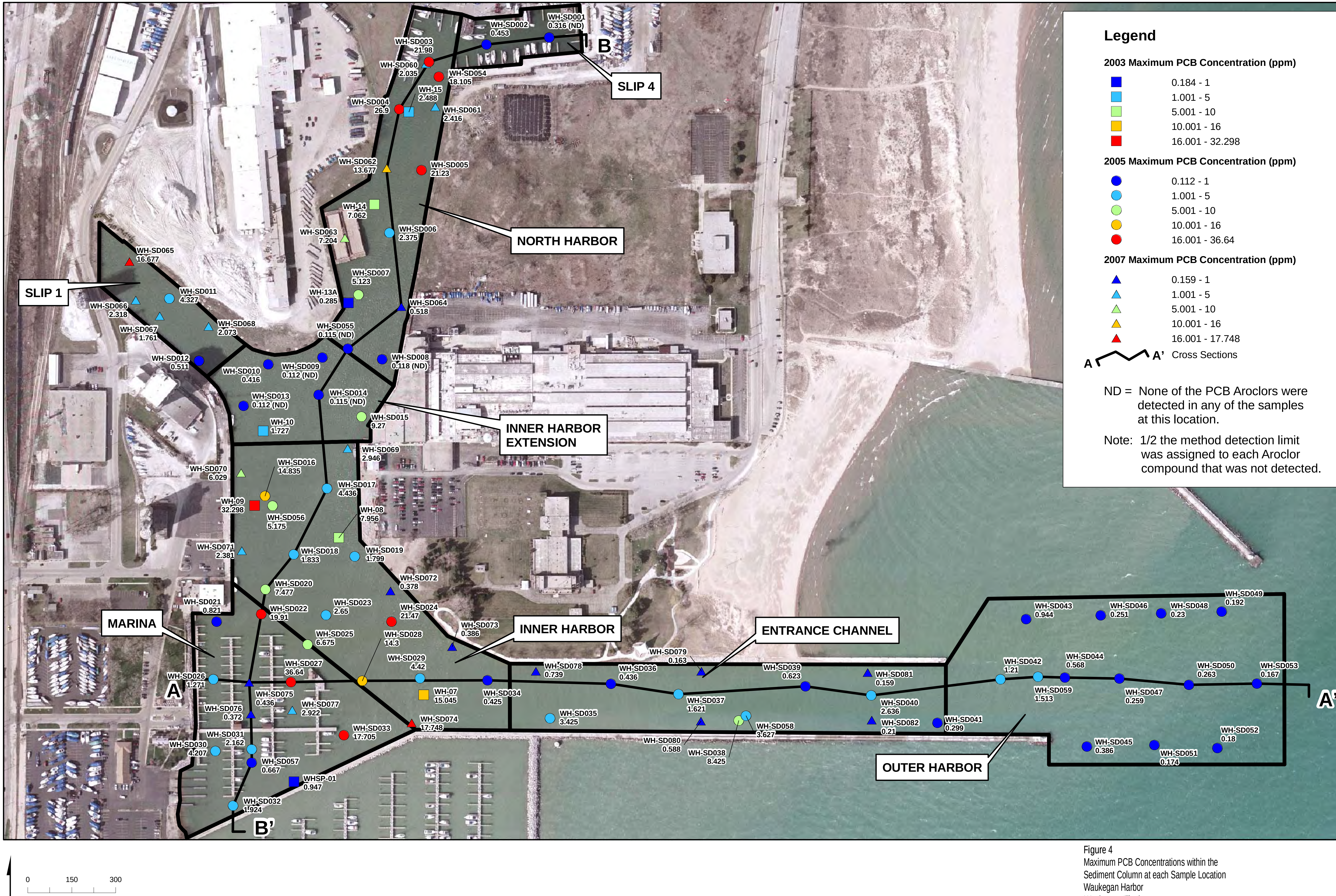


Figure 4
Maximum PCB Concentrations within the Sediment Column at each Sample Location
Waukegan Harbor
Waukegan, Illinois

CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE04_WAUKEGAN_HARBOR_MAXIMUM_PCB_CONCENTRATIONS.MXD 2/21/2008 09:45:35

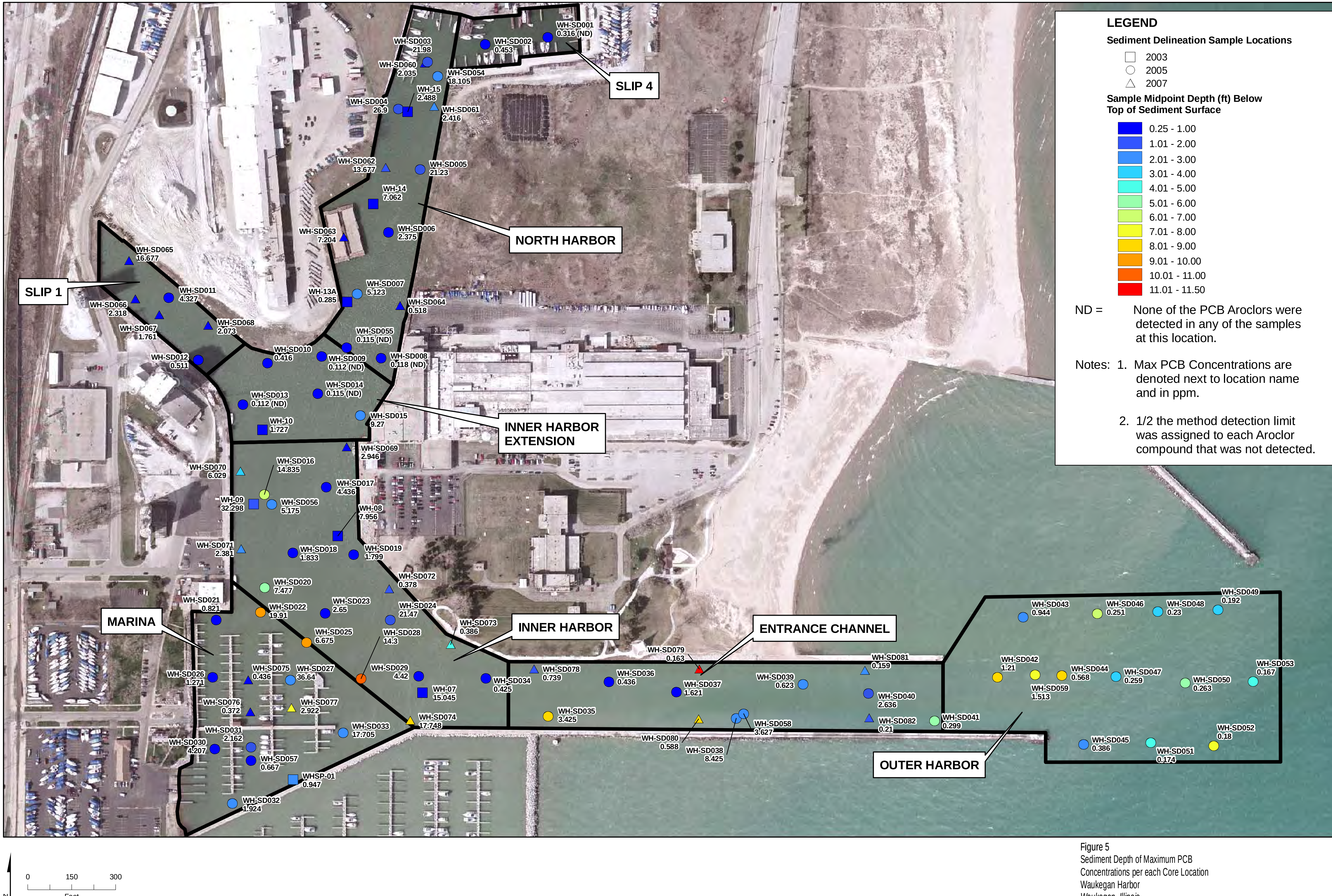
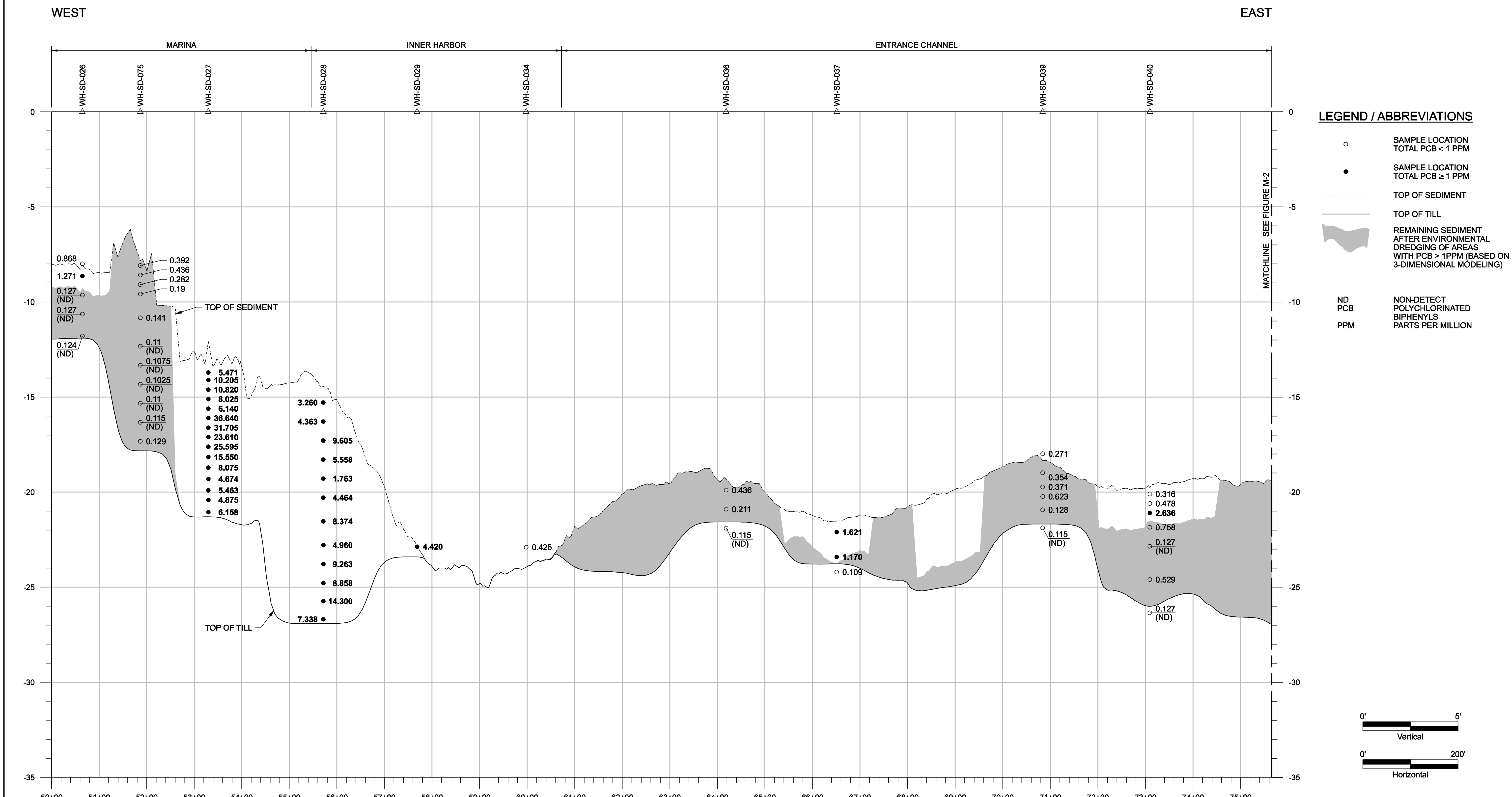


Figure 5
Sediment Depth of Maximum PCB Concentrations per each Core Location
Waukegan Harbor
Waukegan, Illinois

CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE05_WAUKEGAN_HARBOR_MAXIMUM_PCB_CONCENTRATIONS_AT_DEPTH.MXD 2/21/2008 09:53:25

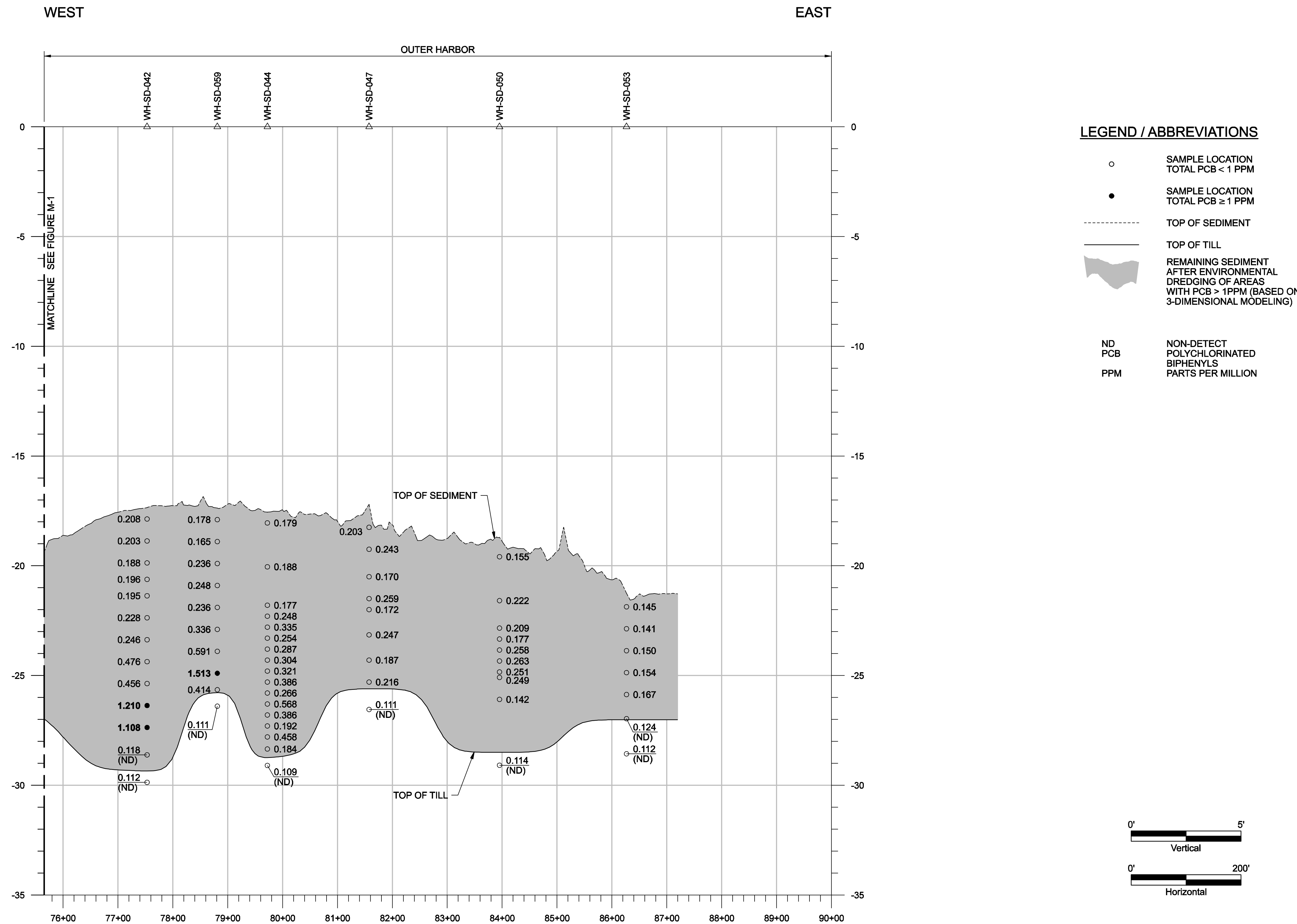


NOTES:

1. SAMPLE DATA REPRESENTS TOTAL PCB CONCENTRATIONS (PPM) AT MIDPOINT ELEVATION OF SAMPLE INTERVAL.
2. ELEVATIONS ARE REPRESENTED IN IGLD85 (INTERNATIONAL GREAT LAKES DATUM 1985).
3. TOP OF SEDIMENT ELEVATIONS IN OUTER HARBOR ARE DERIVED FROM EPA 2005 BATHYMETRY SURVEY DATA. REMAINING HARBOR SEGMENTS USE BATHYMETRIC SURVEY DATA COLLECTED BY VEOLIA ENVIRONMENTAL SERVICES IN NOVEMBER, 2006. ELEVATIONS OF PCB SAMPLES COLLECTED PRIOR TO NOVEMBER, 2006 (WH-SD001 THROUGH WH-SD059) MAY NOT MATCH WITH CURRENT BATHYMETRIC DATA.

FIGURE 6A
SECTION A-A' OF FIGURE 4
WAUKEGAN HARBOR AREA OF CONCERN
WAUKEGAN, ILLINOIS

CH2MHILL



NOTES:

1. SAMPLE DATA REPRESENTS TOTAL PCB CONCENTRATIONS (PPM) AT MIDPOINT ELEVATION OF SAMPLE INTERVAL.
2. ELEVATIONS ARE REPRESENTED IN IGLD85 (INTERNATIONAL GREAT LAKES DATUM 1985).
3. TOP OF SEDIMENT ELEVATIONS IN OUTER HARBOR ARE DERIVED FROM EPA 2005 BATHYMETRY SURVEY DATA. REMAINING HARBOR SEGMENTS USE BATHYMETRIC SURVEY DATA COLLECTED BY VEOLIA ENVIRONMENTAL SERVICES IN NOVEMBER, 2006. ELEVATIONS OF PCB SAMPLES COLLECTED PRIOR TO NOVEMBER, 2006 (WH-SD001 THROUGH WH-SD059) MAY NOT MATCH WITH CURRENT BATHYMETRIC DATA.

FIGURE 6B
SECTION A-A' OF FIGURE 4
WAUKEGAN HARBOR AREA OF CONCERN
WAUKEGAN, ILLINOIS

CH2MHILL

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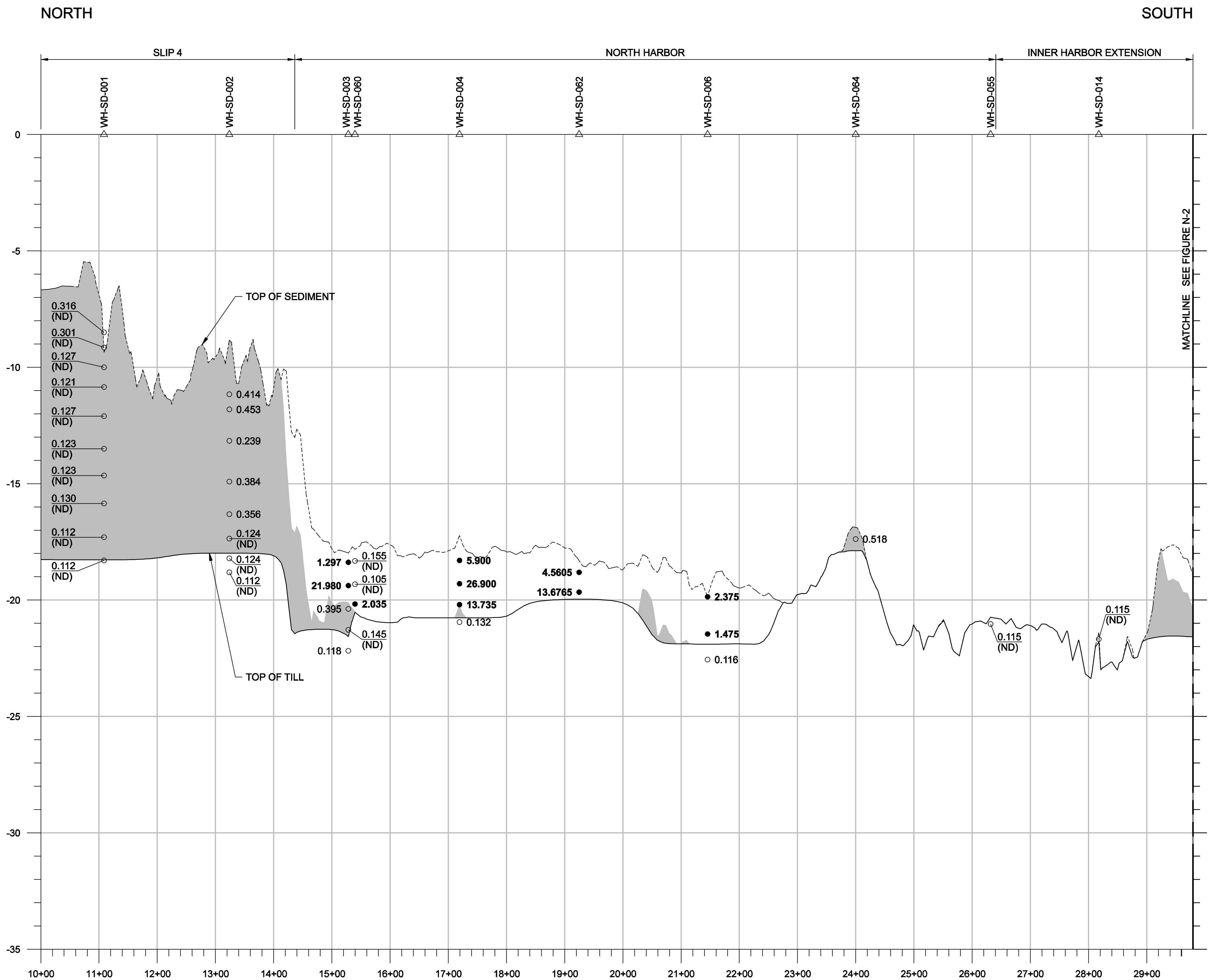

LEGEND / ABBREVIATIONS

○	SAMPLE LOCATION TOTAL PCB < 1 PPM
●	SAMPLE LOCATION TOTAL PCB ≥ 1 PPM
- - - -	TOP OF SEDIMENT
——	TOP OF TILL
(shaded)	REMAINING SEDIMENT AFTER ENVIRONMENTAL DREDGING OF AREAS WITH PCB > 1PPM (BASED ON 3-DIMENSIONAL MODELING)
ND	NON-DETECT
PCB	POLYCHLORINATED BIPHENYLS
PPM	PARTS PER MILLION

0' 5'
Vertical

0' 200'
Horizontal

NOTES:

1. SAMPLE DATA REPRESENTS TOTAL PCB CONCENTRATIONS (PPM) AT MIDPOINT ELEVATION OF SAMPLE INTERVAL.
2. ELEVATIONS ARE REPRESENTED IN IGLD85 (INTERNATIONAL GREAT LAKES DATUM 1985).
3. TOP OF SEDIMENT ELEVATIONS IN OUTER HARBOR ARE DERIVED FROM EPA 2005 BATHYMETRY SURVEY DATA. REMAINING HARBOR SEGMENTS USE BATHYMETRIC SURVEY DATA COLLECTED BY VEOLIA ENVIRONMENTAL SERVICES IN NOVEMBER, 2006. ELEVATIONS OF PCB SAMPLES COLLECTED PRIOR TO NOVEMBER, 2006 (WH-SD001 THROUGH WH-SD059) MAY NOT MATCH WITH CURRENT BATHYMETRIC DATA.

FIGURE 7A
SECTION B-B' OF FIGURE 4
WAUKEGAN HARBOR AREA OF CONCERN
WAUKEGAN, ILLINOIS

CH2MHILL

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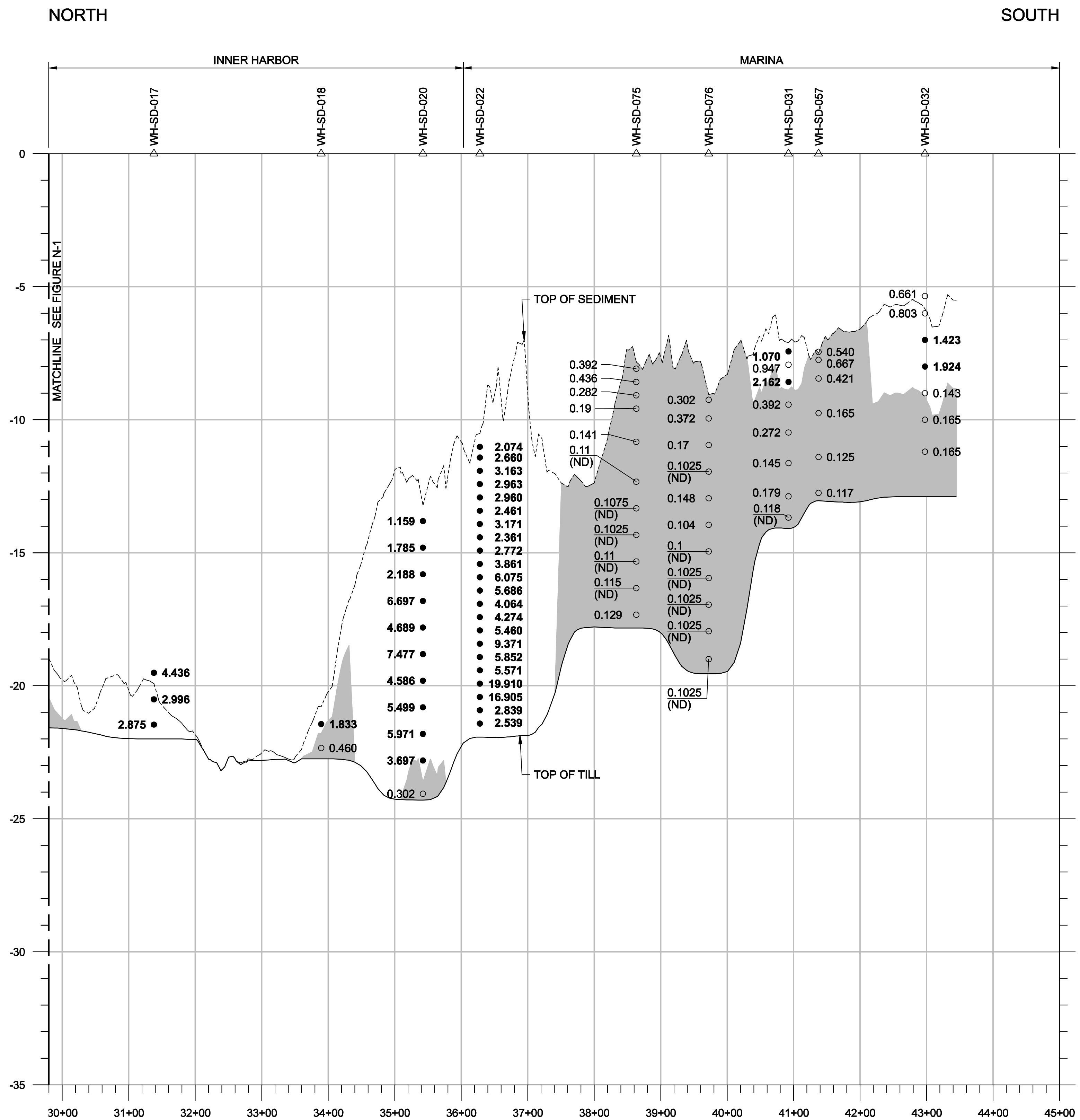

LEGEND / ABBREVIATIONS

○	SAMPLE LOCATION TOTAL PCB < 1 PPM
●	SAMPLE LOCATION TOTAL PCB ≥ 1 PPM
------------	TOP OF SEDIMENT
———	TOP OF TILL
(shaded)	REMAINING SEDIMENT AFTER ENVIRONMENTAL DREDGING OF AREAS WITH PCB > 1PPM (BASED ON 3-DIMENSIONAL MODELING)
ND	NON-DETECT
PCB	POLYCHLORINATED BIPHENYLS
PPM	PARTS PER MILLION

0' 5'
Vertical

0' 200'
Horizontal

NOTES:

1. SAMPLE DATA REPRESENTS TOTAL PCB CONCENTRATIONS (PPM) AT MIDPOINT ELEVATION OF SAMPLE INTERVAL.
2. ELEVATIONS ARE REPRESENTED IN IGLD85 (INTERNATIONAL GREAT LAKES DATUM 1985).
3. TOP OF SEDIMENT ELEVATIONS IN OUTER HARBOR ARE DERIVED FROM EPA 2005 BATHYMETRY SURVEY DATA. REMAINING HARBOR SEGMENTS USE BATHYMETRIC SURVEY DATA COLLECTED BY VEOLIA ENVIRONMENTAL SERVICES IN NOVEMBER, 2006. ELEVATIONS OF PCB SAMPLES COLLECTED PRIOR TO NOVEMBER, 2006 (WH-SD001 THROUGH WH-SD059) MAY NOT MATCH WITH CURRENT BATHYMETRIC DATA.

FIGURE 7B
SECTION B-B' OF FIGURE 4
WAUKEGAN HARBOR AREA OF CONCERN
WAUKEGAN, ILLINOIS

CH2MHILL

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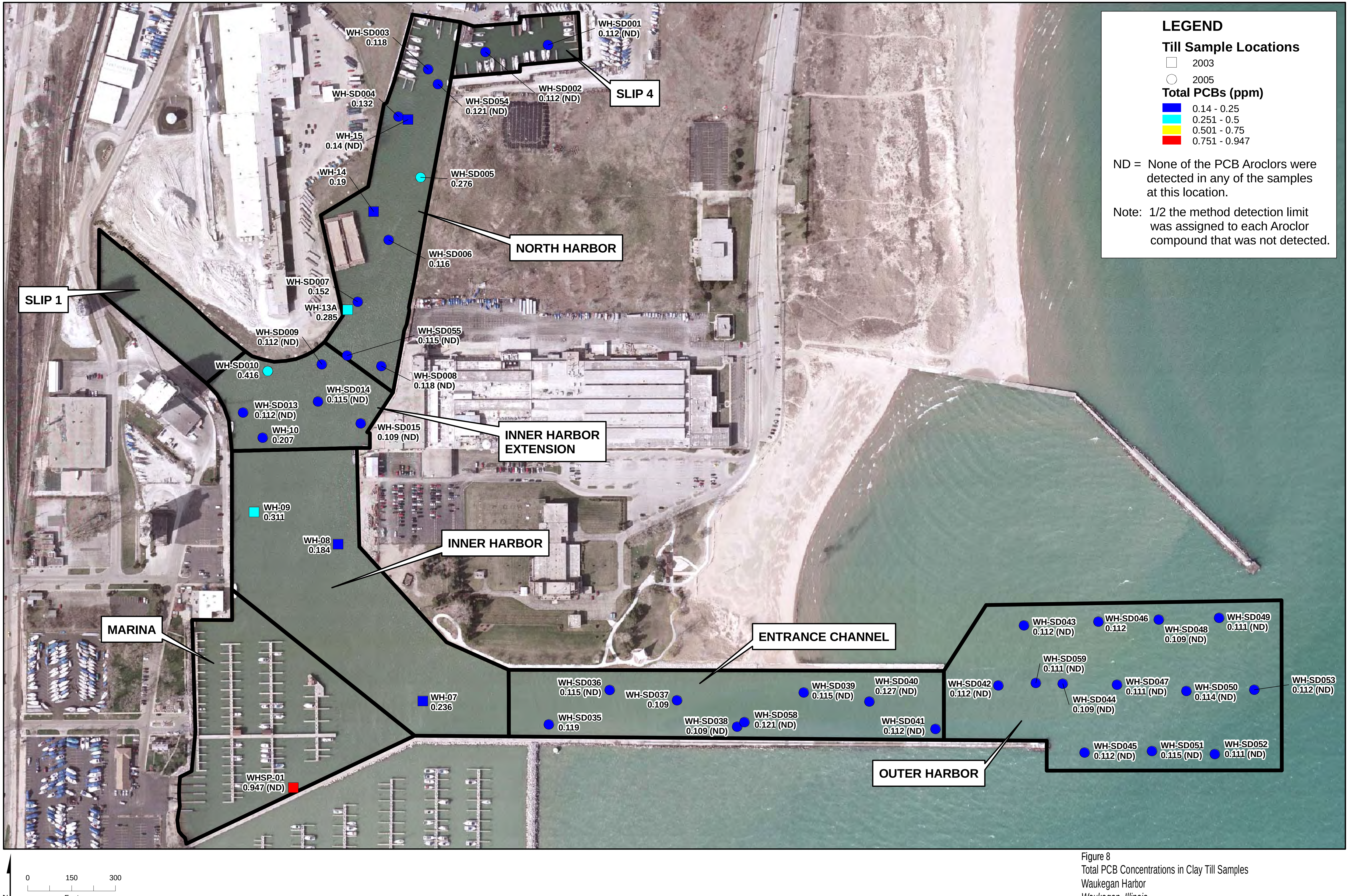
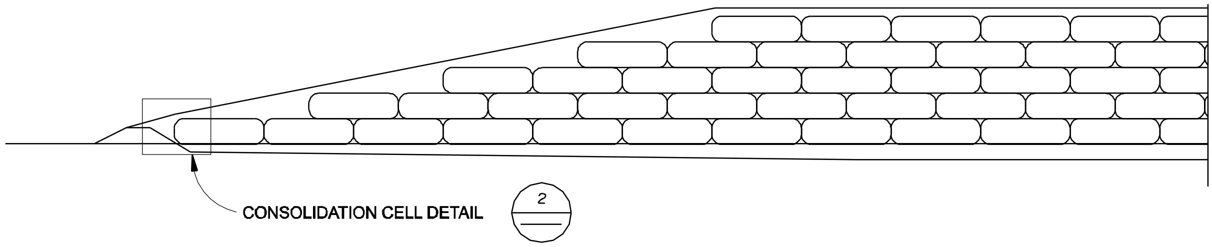


Figure 8
Total PCB Concentrations in Clay Till Samples
Waukegan Harbor
Waukegan, Illinois

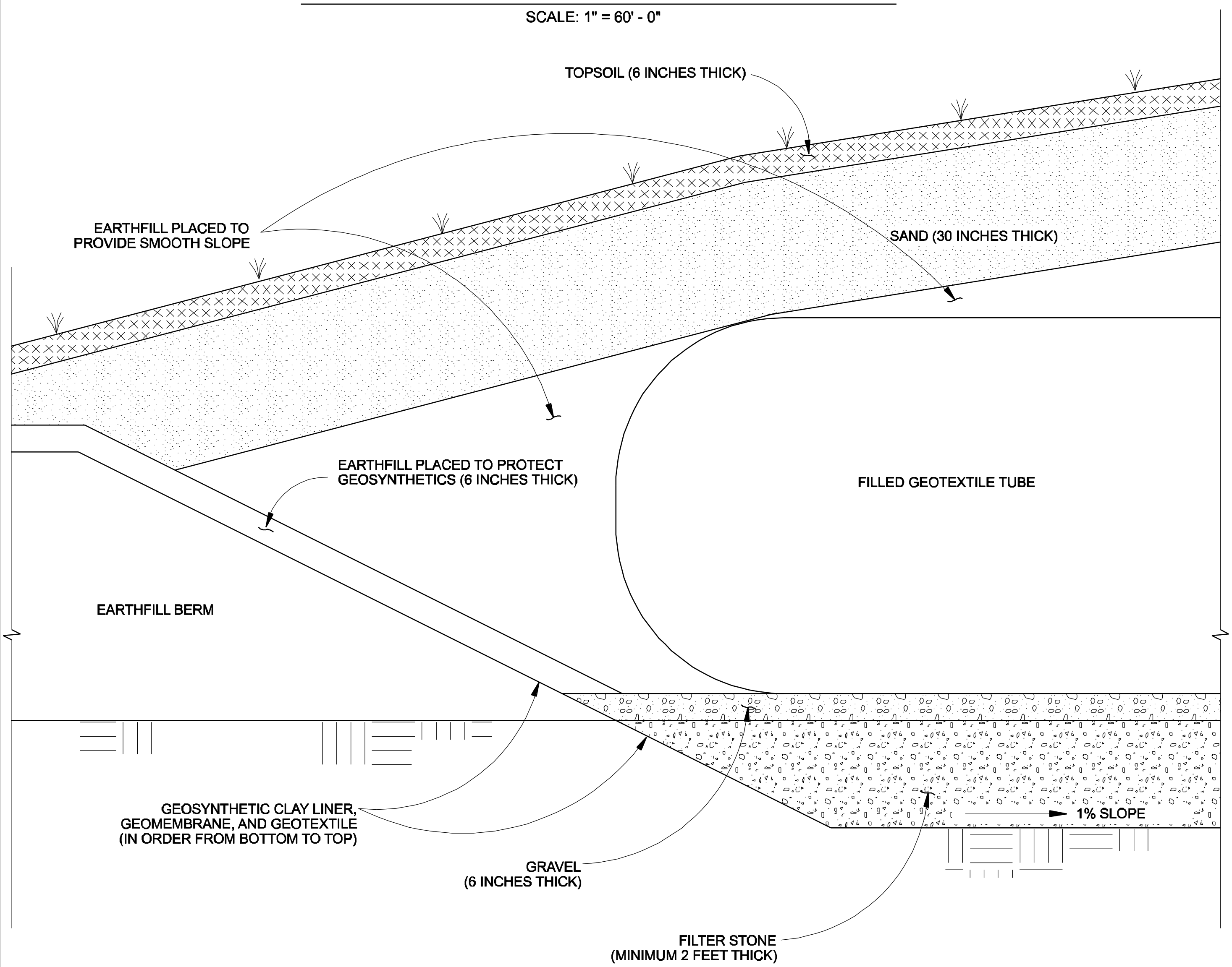
CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE08_WAUKEGAN_HARBOR_SURFACE_PCB_CONCENTRATIONS.MXD 2/13/2008 15:05:16



CONSOLIDATION CELL FOR ONSITE DISPOSAL

SCALE: 1" = 60' - 0"

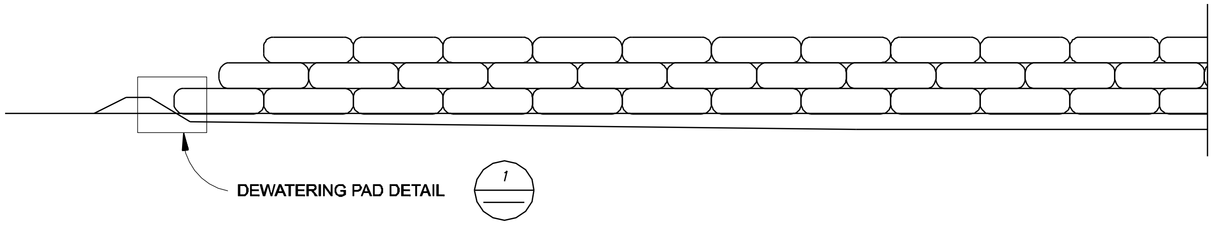


2 CONSOLIDATION CELL DETAIL

SCALE: 1" = 3' - 0"

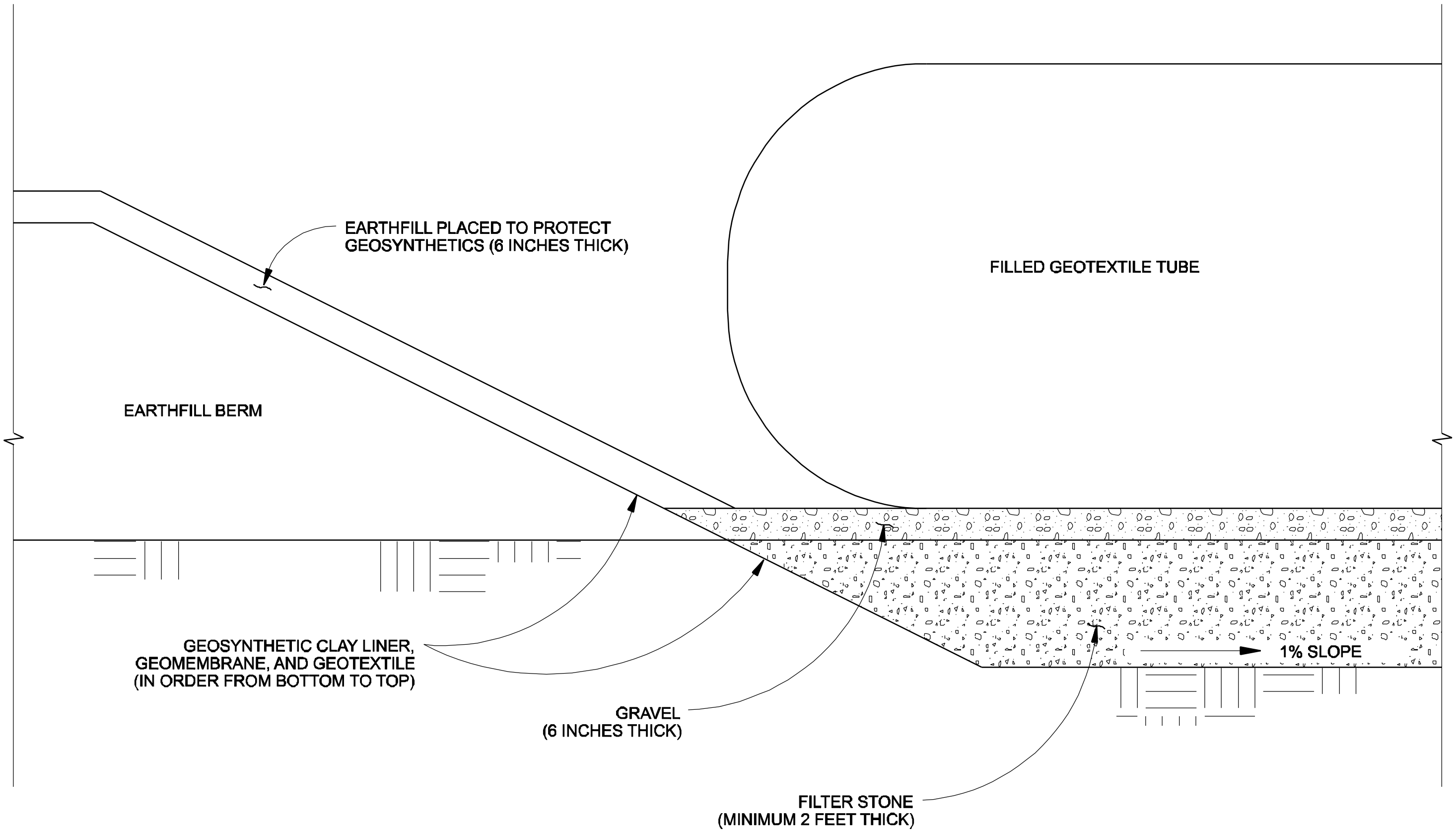
FIGURE 9
CONCEPTUAL DETAILS
ONSITE CONSOLIDATION CELL
WAUKEGAN HARBOR REMEDIAL ALTERNATIVES
WAUKEGAN, ILLINOIS

CH2MHILL



DEWATERING PAD FOR OFFSITE DISPOSAL

SCALE: 1" = 60' - 0"



1 DEWATERING PAD DETAIL

SCALE: 1" = 3' - 0"

FIGURE 10
CONCEPTUAL DETAILS
DEWATERING PAD FOR OFFSITE DISPOSAL
WAUKEGAN HARBOR REMEDIAL ALTERNATIVES
WAUKEGAN, ILLINOIS

CH2MHILL

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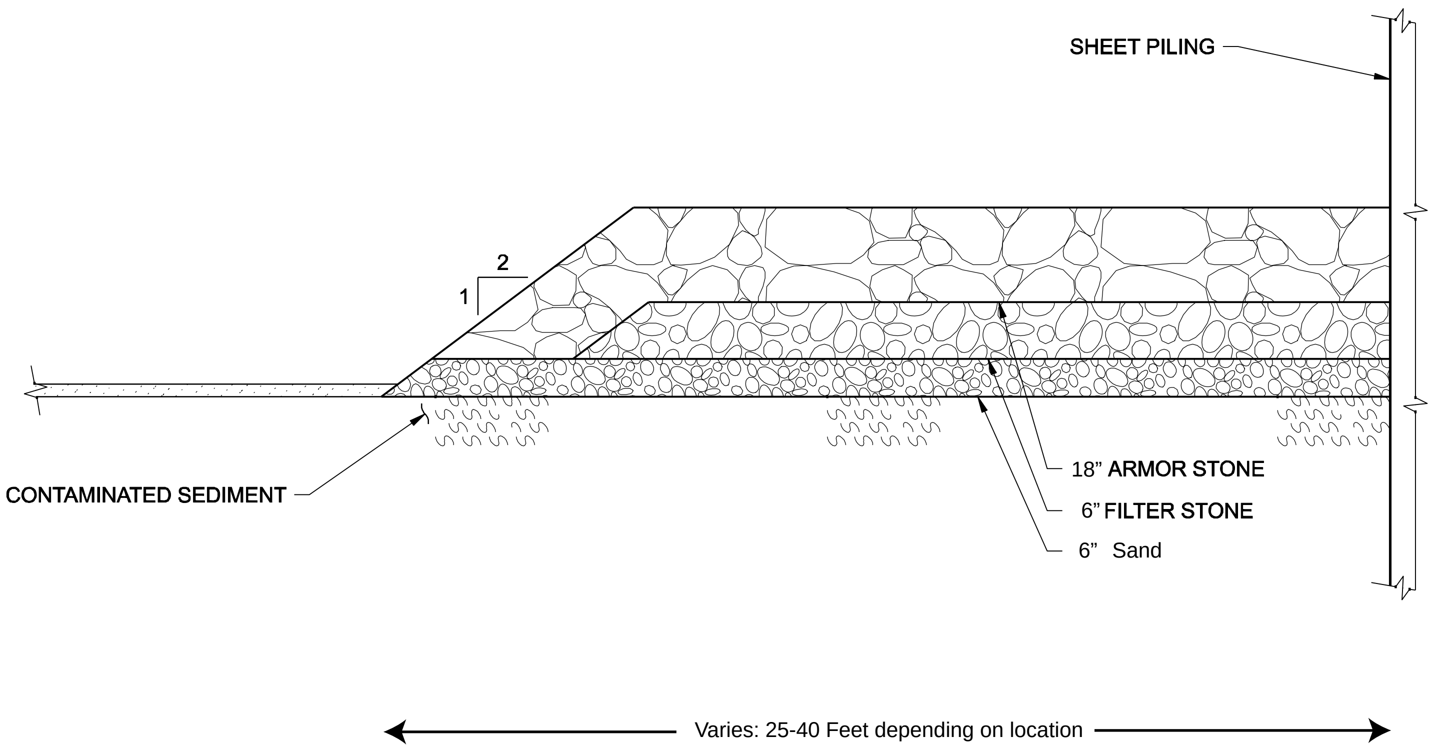
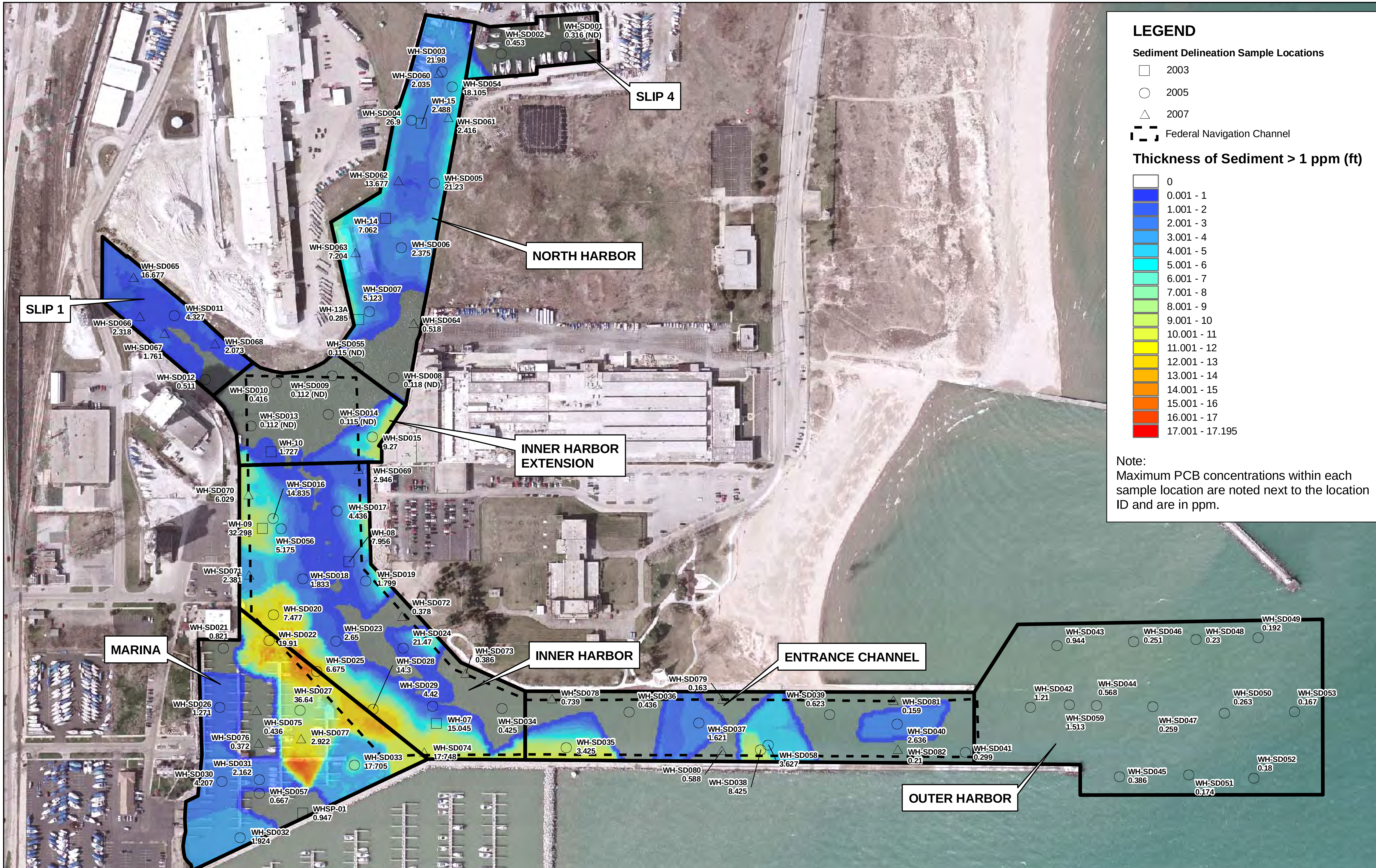


Note: Material thickness does not include overplacement allowance.

Figure 11
Seawall Sediment Protection Berm
Waukegan Harbor

CH2MHILL



N
0 150 300
Feet

Figure 12
Thickness of Sediment Requiring Remediation
Waukegan Harbor
Waukegan, Illinois

CH2MHILL

MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE12_WAUKEGAN_HARBOR_THICKNESS_OF_SEDIMENT_GRTR_1PPM.MXD 2/22/2008 14:17:51

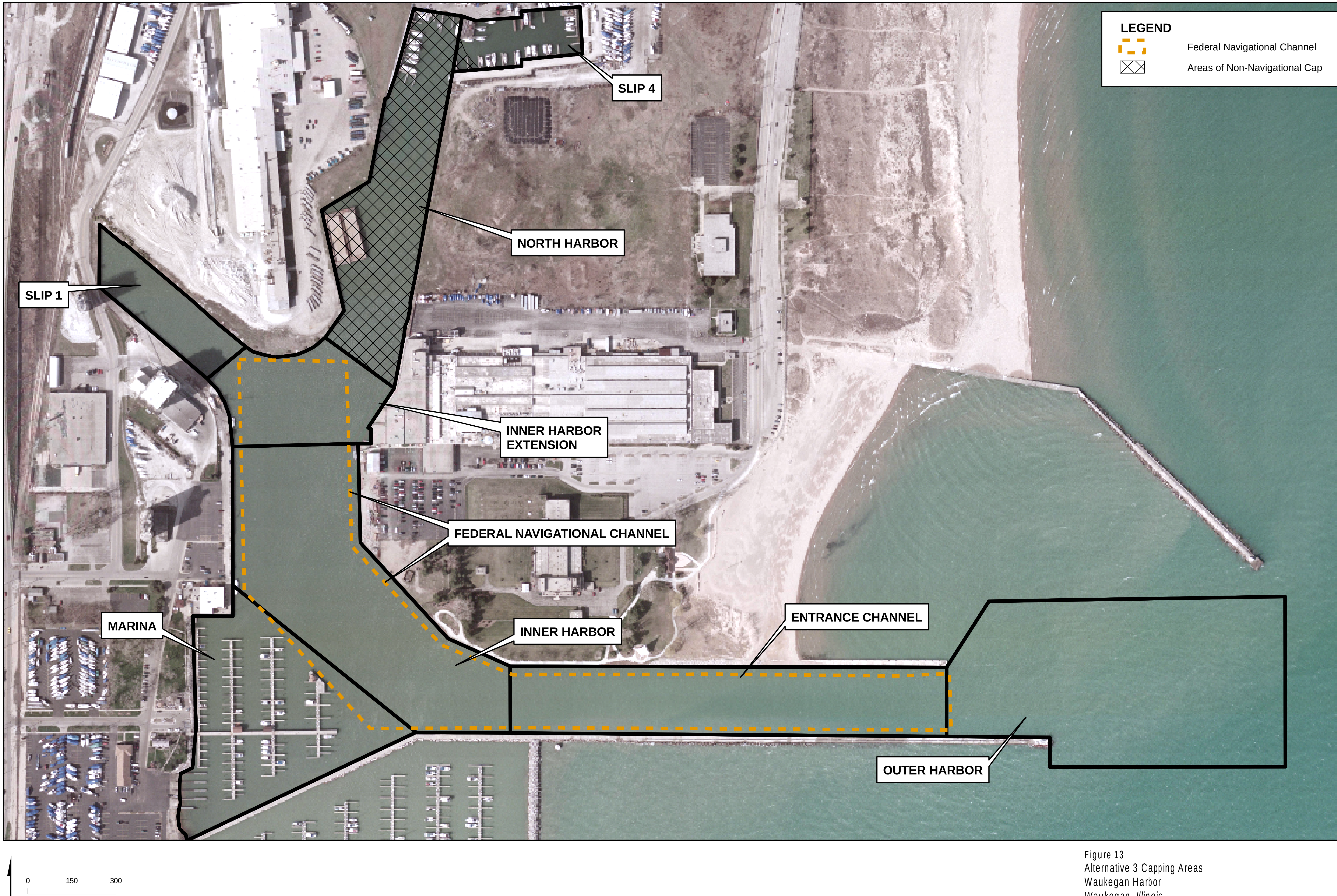


Figure 13
Alternative 3 Capping Areas
Waukegan Harbor
Waukegan, Illinois

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MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE13_WAUKEGAN_HARBOR_ALTERNATIVE_3_CAPPING_AREAS.MXD 4/21/2008 15:08:05

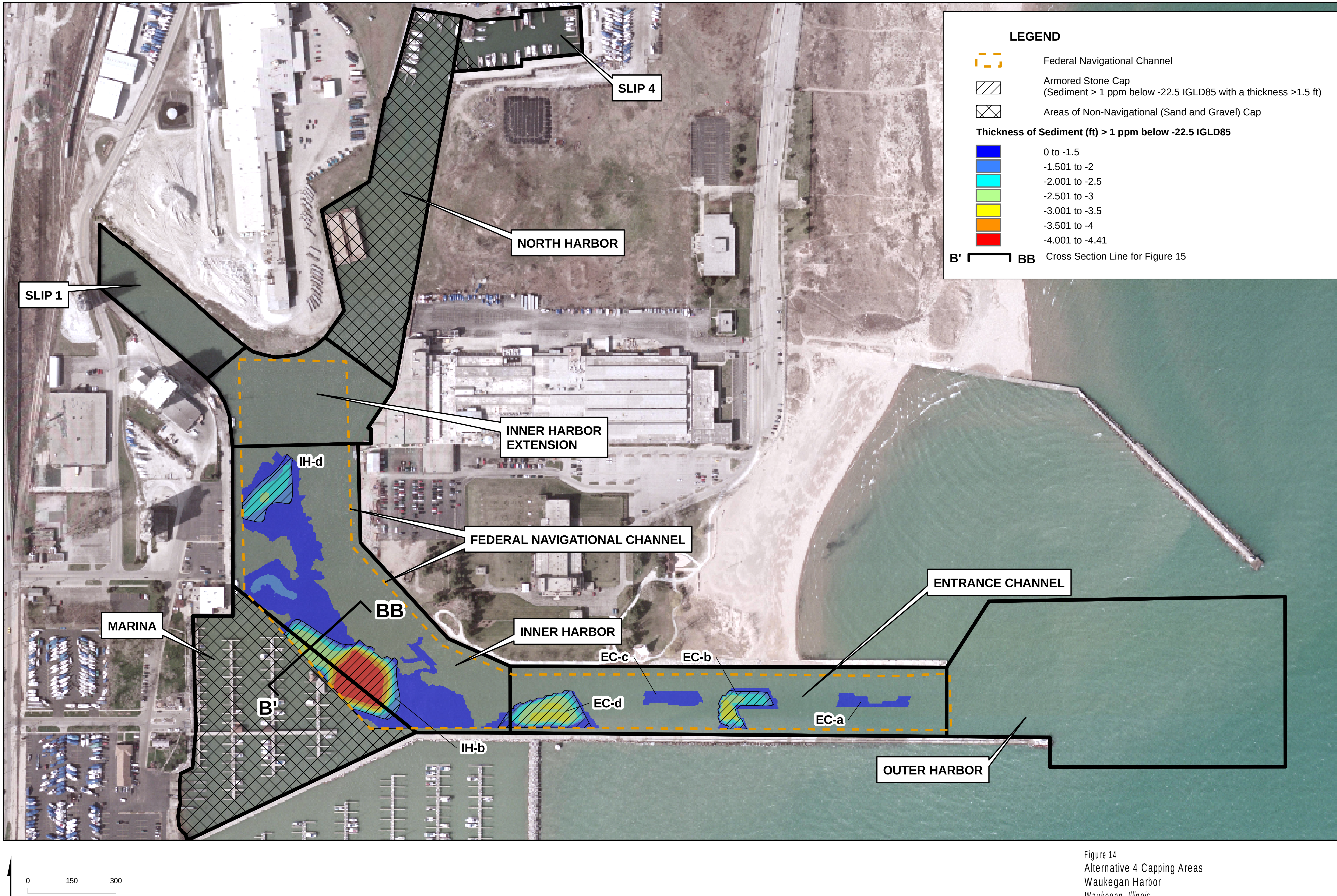

Figure 14
Alternative 4 Capping Areas
Waukegan Harbor
Waukegan, Illinois

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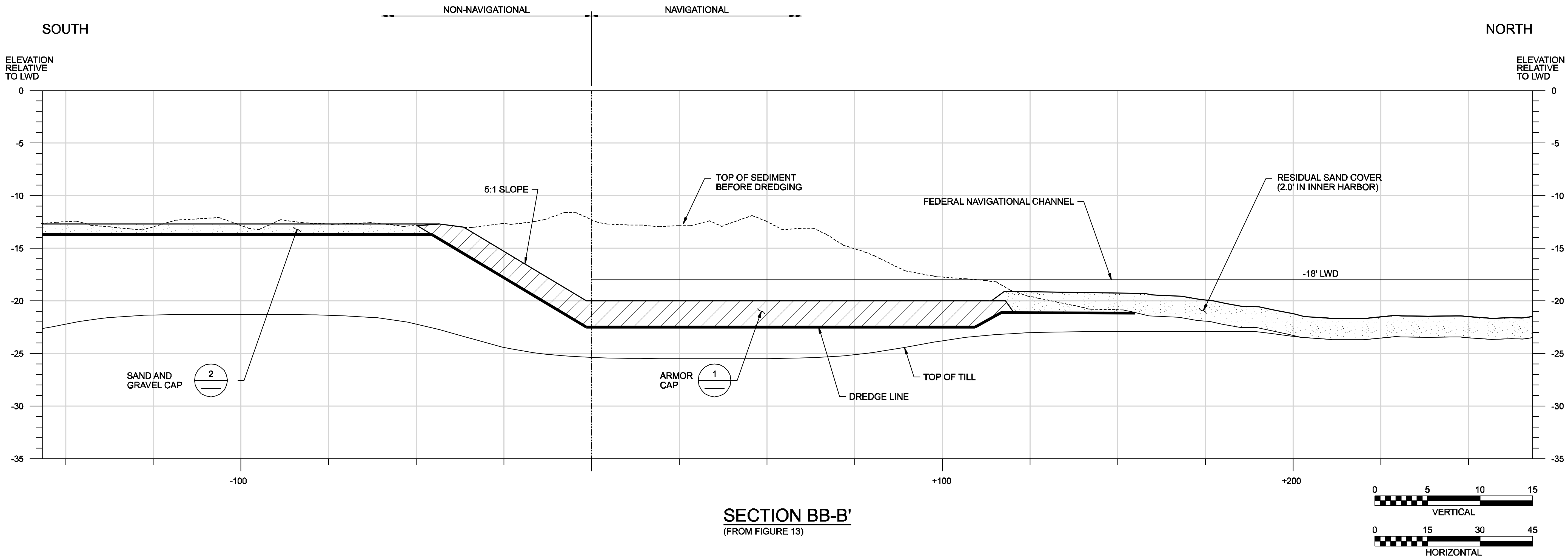
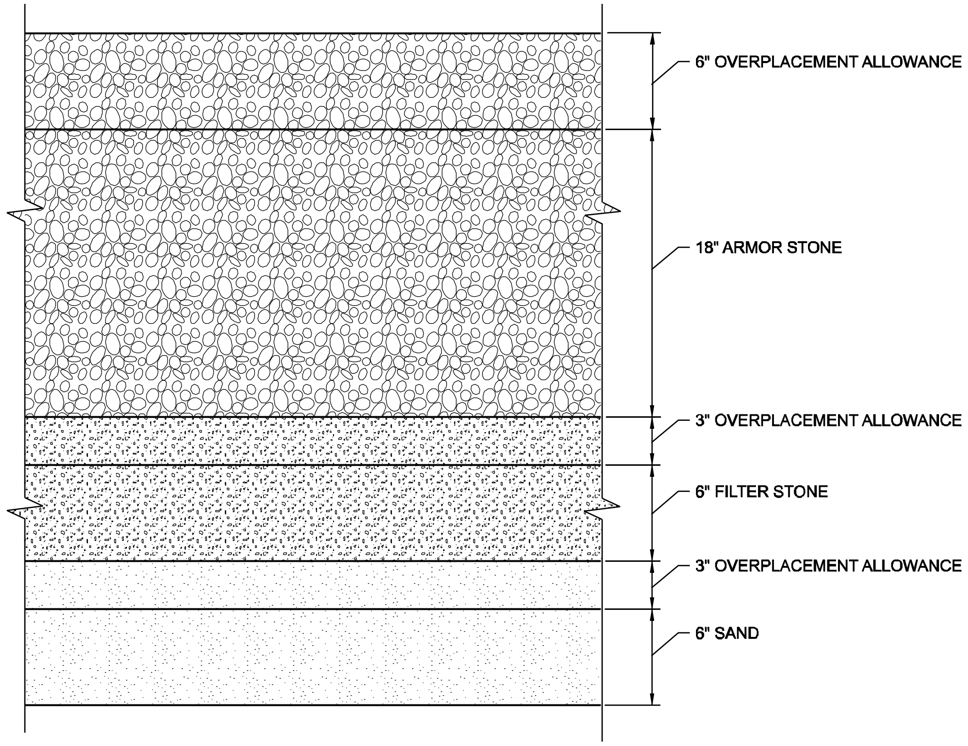
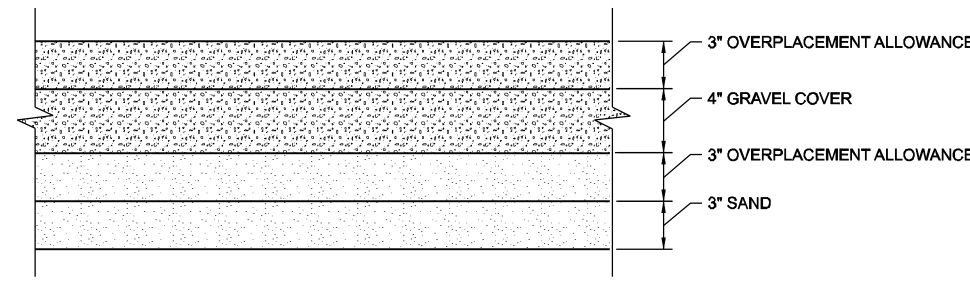
MKE \\WAVE\PROJ\EPA\182500_WAUKEGAN_HARBOR\GIS_DATA\MXDS\2008\FS_REPORT\FIGURE14_WAUKEGAN_HARBOR_ALTERNATIVE_4_CAPPING LOCATIONS.MXD 4/21/2008 15:14:14



SECTION BB-B'
(FROM FIGURE 13)





2 SAND AND GRAVEL CAP DETAIL
SCALE 1" = 1'-0"

1 ARMOR CAP DETAIL
SCALE 1" = 1'-0"

FIGURE 15
ARMOR CAP DETAILS FOR SECTION THROUGH THE MARINA
WAUKEGAN HARBOR AREA OF CONCERN
WAUKEGAN, ILLINOIS

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FILENAME: Figure15_Waukegan_Harbor_Armor_Cap_Details_Through_Marina.dgn PLOT DATE: 4/21/2008 PLOT TIME: 2:34:03 PM

Appendix A
Summary of ARARs for the Waukegan Harbor Site

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
Chemical-Specific ARARs/TBCs			
Clean Water Act Section 404 3 USC 144; 33 CFR 323 40 CFR Parts 230 33 CFR Parts 320–330 40 CFR Part 132	Requires approval from USACE for discharge of dredged or fill material into waters of the United States (CWA Section 404 Permit). The Corps and USEPA regard the use of mechanized earth-moving equipment to conduct land-clearing, ditching, channelization, in-stream mining or other earth-moving activity in waters of the United States as resulting in a discharge of dredged material unless project-specific evidence shows that the activity results in only incidental fallback. Discharges of dredged or fill materials are not permitted unless there is no practicable alternative that would have less adverse impact on the aquatic ecosystem. Any proposed discharge must avoid, to the fullest extent practicable, adverse effects, especially on aquatic ecosystems. Unavoidable impacts must be minimized, and impacts that cannot be minimized must be mitigated. 40CFR Part 132 provides guidance for setting discharge limits for bioaccumulative contaminants such as PCBs.	2, 3, 4, 5	The substantive requirements of a permit for discharge of dredged materials will be met. Though actual discharge of dredged material back into the harbor is not anticipated, excavation within the harbor constitutes discharge of dredged material. Requirements are likely to include measures to minimize re-suspension of sediments and erosion of sediments during excavation. Discharge limits for PCBs will likely be set at non-detectable levels.
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 208(b)	The proposed action must be consistent with regional water quality management plans as developed under Section 208 of Clean Water Act.	2, 3, 4, 5	Substantive requirements adopted by the state pursuant to Section 208 of the Clean Water Act would be applicable to direct discharge of treatment system effluent or other discharges to surface water.
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 304	Establishes water quality criteria for specific pollutants for the protection of human health and aquatic life. These federal water quality criteria are non-enforceable guidelines used by the state to set water quality standards for surface water.	2, 3, 4, 5	TBC. Point source discharges from sediment dewatering will meet requirements of NPDES discharge permit. Water quality criteria are TBCs used in setting standards for discharges to surface water.

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
40 CFR Parts 122, 125	Requires the development and implementation of a stormwater pollution prevention plan or a stormwater best management plan. Also outlines monitoring and reporting requirement for a variety of facilities.	2, 3, 4, 5	May be applicable to runoff from construction activities depending on the nature of the remedial action selected.
40 CFR Part 131–Water Quality Standards	States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of surface water bodies in the state.	2, 3, 4, 5	Applicable to direct discharge of treatment system effluent.
Location-Specific ARARs/TBC			
Great Lakes Water Quality Agreement of 1978	Calls for prohibition of the discharge of toxic substances in toxic amounts and for the virtual elimination of the discharge of persistent substances.	2, 3, 4, 5	TBC. Standards established by the agreement are policies to be considered.
Fish and Wildlife Coordination Act 16 USC §661 et seq. 16 USC §742 a 16 USC §2901 40 CFR 6.302 50 CFR 402–Fish and Wildlife Coordination Act	Requires consultation when a modification of a stream or other water body is proposed or authorized and requires protection of fish and wildlife from adverse effects of site action.	2, 3, 4, 5	ARAR. Relevant and appropriate for Waukegan Harbor AOC for removal of contaminated sediment.
Coastal Zone Management Act 16 USC §1451 et. seq. 15 CFR 930	Requires that Federal agencies conducting activities directly affecting the coastal zone conduct those activities in a manner that is consistent, to the maximum extent practicable, with approved State coastal zone management programs.	2, 3, 4, 5	Applicable to dredging and in situ capping, and any construction in the coastal zone.

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
Endangered Species Act of 1973 16 USC §1531 et seq. 50 CFR 200	Requires that Federal agencies insure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	2, 3, 4, 5	No endangered species known to be present that would be affected by sediment excavation activities.
Rivers and Harbors Act of 1899 Section 10 (33 USC §401et. seq.) 33 CFR 403 33 CFR 322	Requires approval from USACE for dredging and filling work performed in a navigable waterway of the U.S. Activities that could impede navigation and commerce are prohibited.	2, 3, 4, 5	ARAR. The substantive requirements of a permit will be met. Permits are not required for Super-fund response actions. Typical requirements of dredging permits include measures to minimize re-suspension of sediments and erosion of sediments and stream banks during excavation.
National Historical Preservation Act 16 USC §661 et seq. 36 CFR Part 65	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the site, work in the area of the site affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the act and its implementing regulations.	2, 3, 4, 5	May be relevant and appropriate during the remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.
Executive Order11990 50 CFR Part 6, Appendix A	Requires actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.	2, 3, 4, 5	TBC. Will be considered for wetlands if present within sediment disposal areas.
Executive Order 11988 50 CFR Part 6, Appendix A	Requires actions to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains.	2, 3, 4, 5	TBC. Will be considered for floodplains if present within sediment disposal areas.
Great Lakes Water Quality Initiative Part 132, Appendix E	Provides guidance to Great Lakes states regarding wastewater discharge, stating that lowering of water quality standards via wastewater discharge should be minimized.	2, 3, 4, 5	TBC. Considered as guidance.

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
Action-Specific ARARs/TBC			
Clean Air Act 40 CFR 50-99	Specifies requirements for air emissions such as particulates, sulfur dioxide, VOCs, hazardous air pollutants, and asbestos.	2, 3, 4, 5	ARAR. Particulates are not likely to be generated during excavation of sediments. Best available practices to control particulates will be used, as needed, during the dewatering of sediments.
40 CFR 241–Guidelines for Land Disposal of Solid Wastes	Offsite solid waste land disposal units must meet the federal guidelines for the land disposal of solid wastes.	2a, 3a, 4a	Applicability depends on waste classification for soil and water treatment residuals.
Subtitle D, 40 CFR 257–Criteria for Classification of Solid Waste Disposal Facility and Practices	Sets standards for land disposal facilities for nonhazardous waste.	2a, 3a, 4a	Applicable to water treatment residuals and to transport and disposal of any nonhazardous solid waste offsite.
40 CFR 262 and 263 49 CFR 100 through 199	Establishes responsibilities for transporters of hazardous waste in handling, transportation, and management of the waste. Sets requirements for manifesting, record keeping, and emergency response action in case of a spill.		Not ARARs. The sediments are not hazardous waste.
Subtitle C, 40 CFR 260 through 264	Regulates the generation, transport, storage, treatment, and disposal of hazardous wastes generated in the course of a remedial action. Regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities.		Not ARARs. The sediments do not have to be managed as containing listed hazardous waste because specific documentation of the release of a listed waste to the sediments is not available. The sediments also are not characteristic waste, and are exempted from regulation under RCRA because CWA Section 404 applies to the cleanup activity (40 CFR 261).
40 CFR 264, Subpart K–Surface Impoundments (40 CFR 264.221 to 264.228)	Establishes the design and operating, monitoring, and closure requirements for surface impoundments containing hazardous waste. Requires that all impoundments have a liner system to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil or groundwater or surface water any time during the life of the impoundment.		Not ARARs. The sediments are not hazardous waste.

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
40 CFR 264, Subpart M–Land Treatment (40CFR 264.271 to 264.280)	Establishes the demonstration program, design and operating, monitoring, and closure requirements for hazardous waste land treatment units.		Not ARARs. The sediments are not hazardous waste.
40 CFR 268 Land Disposal Restrictions	The land disposal restrictions require treatment before land disposal for a wide range of hazardous wastes.		Not ARARs. The sediments are not hazardous waste.
Toxic Substances Control Act (TSCA) PCB Remediation Wastes 40 CFR 761.61	Specifies requirements for self-implementing on-site cleanup of PCB remediation waste.		Not an ARAR. Requirements are not binding on CERCLA sites (761.61 (a)(1)(ii)). Self-implementing requirements are not applicable to sediments.
TSCA Site Cleanup. (761.61(a)(5)(B)(2)(iii).	Remediation waste with PCBs > 50 mg/kg must be disposed of in a TSCA chemical waste landfill or a RCRA hazardous waste landfill.		Not an ARAR. Sediments have PCB concentrations < 50 mg/kg. If PCBs > 50 mg/kg are excavated, however, disposal will be performed in accordance with these requirements.
TSCA Performance-based Cleanup (761.61(b)(3)).	Material that has been dredged or excavated from waters of the United States must be managed in accordance with a permit issued under section 404 of the Clean Water Act, or the equivalent of such a permit.	2, 3, 4	ARAR. Although a permit is not necessary for a Superfund site, the substantive requirements of the permit must be met.
TSCA (40CFR 761.65) Storage for Disposal	Bulk PCB remediation waste containing > 50 mg/kg PCBs may be stored onsite for up to 180 days, provided controls are in place for prevention of dispersal by wind or generation of leachate. Storage site requirements include a foundation below the liner, a liner, a cover, and a run-on control system.		Not an ARAR. Sediments have PCB concentrations < 50 mg/kg; however, if PCBs > 50 mg/kg are excavated, storage piles will be designed to meet these requirements. An extension on the 180-day storage limit could be obtained if needed through a notification to EPA per 40 CFR 761.65 (a).

TABLE 3-2
Summary of State ARARs

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
Chemical-Specific ARARs/TBCs			
Title 35, Subtitle B: Air Pollution	Regulations contain specific requirements that pertain to allowable emissions of criteria pollutants from a number of air contaminant source categories and processes.	2, 3, 4	ARAR. Substantive requirements for air emission control must be met.
IAC 35, Part 212 Visible and Particulate Matter Emissions	Regulations contain specific requirements that pertain to allowable emissions of fugitive particulate matter.	2, 3, 4	ARAR. Dust control must be implemented to control visible particulate emissions.
IAC 35, Part 245 Odors	Regulations specify how to determine whether a nuisance odor is present.	2, 3, 4	ARAR. Odor control may be necessary if it is determined that a nuisance odor is present as a result of sediment remediation.
IAC 35, Part 302 Surface Water Standards	Designates surface water quality standards used in setting effluent limits for discharges to surface water. Total ammonia in the harbor must not exceed 15,000 µg/l. and in the open waters of Lake Michigan must not exceed 20 µg/l. The acute (A; within mixing zone) and chronic (C; outside mixing zone) aquatic life standard for unionized ammonia for the harbor are as follows: April to October - 330 µg/l (A) and 57 µg/l (C) November to March - 140 µg/l (A) and 25 µg/l (C). PCBs- human health standard for the harbor is 0.000026 µg/l and the wildlife standard is 0.00012 µg/l.	2, 3, 4, 5	ARAR The standards are used in setting the discharge limits for discharges to surface water. The harbor waters are defined as Lake Michigan basin water while water outside the harbor are defined as Open Waters of the Lake Michigan basin.
IAC 35, Part 304 Effluent Standards	Designates specific effluent limits for discharges to surface water.	2, 3, 4, 5	ARAR. Substantive requirements must be met for discharges to surface water of water from sediment dewatering.
IAC 35, Part 309 Permits	Designates process used in setting NPDES effluent limits for discharges to surface water.	2, 3, 4, 5	ARAR. Substantive requirements must be met for discharges to surface water of water from sediment dewatering.

TABLE 3-2
Summary of State ARARs

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
IAC 35, Part 307 Sewer Discharge Criteria, 1101-1103 General and Specific Pretreatment Requirements.	Designates general requirements for discharges to POTWs such as no discharge of pollutants which pass through the POTW or interfere with the operation and performance of the POTW. Also gives specific limits for discharge of certain pollutants.	None	ARAR. Substantive requirements must be met for discharges to North Shore Sanitary District POTW of water from sediment dewatering.
IAC 35, Part 310 Pretreatment Programs. 310.201-202.	Designates general requirements for discharges to POTWs such as no discharge of pollutants which pass through the POTW or interfere with the operation and performance of the POTW. Also requires POTWs to develop Pretreatment programs.	None	ARAR. Used by Northshore Sanitary District in setting pretreatment discharge requirements for discharge of water from sediment dewatering.
IAC 35, Subtitle G: Waste Disposal, Subchapter c: Hazardous Waste Operating Requirements, Parts 720- 729.	Standards applicable to hazardous waste generators, transporters and operators of hazardous waste treatment storage and disposal facilities.		Not an ARAR. The sediments are not required to be managed as containing listed hazardous waste because specific documentation of the release of a listed waste to the sediments is not available. The sediments also are not characteristic waste. Also the sediments are exempted from regulation under RCRA because CWA Section 404 applies to the cleanup activity (40 CFR 261(g)).

TABLE 3-2
Summary of State ARARs

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
IAC 35, Subtitle G: Subchapter f: Part 740 Site Remediation Program, Section 740.535 Establishment of Soil Remediation Zones.	Presents requirements for the site remediation program and specific requirements for establishment of soil management zones (SMZ). SMZs can be used for onsite placement of contaminated soils for structural fill or land reclamation or consolidation of contaminated soils within a remediation site. Soil to be placed in the SMZ must have PCBs < 50 ppm. Also, all exposure routes related to the SMZ must be addressed. The SMZ must have institutional controls and an engineered barrier meeting the requirement of 742.1005. For the direct contact pathway an engineered barrier may be buildings, highways, compacted clay, asphalt or concrete or 3 ft of soil. Where the leaching to groundwater pathway poses unacceptable risk the engineered barrier may include clay, concrete, asphalt or other material approved by IEPA. Soil with contaminants exceeding criteria cannot be placed in areas of soil meeting criteria (i.e. consolidation area also must exceed at least one of the residential Tier 1 soil remediation objective values in IAC 35 742 Appendix B table A).	2b, 3b, 4b	ARAR. Remediation program requirements must be met for remediation of PCBs in sediment. SMZ can be used for placement of contaminated sediment onsite as long as consolidation area exceeds residential soil remediation objective values.
IAC 35, Subtitle G: Subchapter f: Part 742. Tiered Approach to Remedial Action Objectives.	Presents requirements for the tiered approach to corrective action objectives (TACO).	2, 3, 4, 5	ARAR. Remediation program requirements must be met for remediation of PCBs in sediment.
IAC 35, Subtitle G: Subchapter i: Parts 807 to 815 Solid Waste and Special Waste Hauling.	Presents requirements for hauling and disposing solid wastes and special wastes. Includes requirements for new solid waste landfills.	2a, 3a, 4a	ARAR. Contaminated sediment must be transported and disposed in accordance with requirements of IAC 35 Subchapter i. New landfills for offsite disposal of contaminated sediment must meet the requirements of Part 811.

TABLE 3-2
Summary of State ARARs

Citation	Requirement/Purpose	Alternatives Affected	ARAR Status
IAC 35, Subtitle G: Subchapter i: Part 808 Special Waste Classifications.	Special waste must be treated, stored or disposed at a facility permitted to manage special waste. Presents the special waste classes and the method to determine whether the solid waste is a special waste and if so, whether it is Class A (all non-Class B special wastes) or Class B (low or moderate hazard special wastes). RCRA hazardous waste is not included within the special waste classes.	2a, 3a, 4a	ARAR. Contaminated sediment with PCBs is a Class A special waste. The main factor affecting the classification is the large volume of contaminated sediment to be disposed rather than the PCB concentration. Offsite disposal of PCB contaminated sediment must be at a Solid Waste landfill permitted to receive Class A special waste unless IEPA specifically allows otherwise.
Title 35, Subtitle H: Noise	Regulations contain specific requirements that pertain to nuisance noise levels.	2, 3, 4, 5	ARAR. Noise levels will need to be controlled if noise reaches nuisance levels.
Lake County Stormwater Management Commission, Watershed Development Ordinance	Regulations specify performance standards for stormwater control.	2, 3, 4, 5	ARAR. Activities such as sediment dewatering or sediment disposal need to be evaluated relative to stormwater controls.

Appendix B

Surface-Weighted Average Concentration Calculation Methodology

APPENDIX B

Surface-Weighted Average Concentration (SWAC) Calculation Methodology

Introduction

This memorandum summarizes the process and calculations used to determine the SWAC values representative of existing and post-remedial action conditions in the Waukegan Harbor. The basis of the SWAC approach is that the exposure domain for receptors is broader than the small areas represented by individual samples, so an average concentration of the exposure domain should be calculated and used.

Existing Conditions SWAC

The following steps were used to develop the existing conditions SWAC for each individual segment (Slip 4, North Harbor, Inner Harbor Extension, Slip 1, Inner Harbor, Marina, Entrance Channel, and Outer Harbor) and also for the entire Harbor with all segments combined.

1. Before calculating a SWAC for the individual segments, a representative concentration for each sample location was determined. A depth-weighted average (DWA) approach was used for calculating the PCB concentrations in the surface sediment when multiple samples were collected from the same location. The DWA approach uses the formula:

   $$PCB_{dwa} = \frac{\sum PCB_i \, \Delta Z_i}{\sum \Delta Z_i}$$

   Where PCB_{dwa} is the DWA concentration, PCB_i is the PCB concentration of the depth interval i, and ΔZ_i is the length of the sample interval. Depth-weighted surface core concentrations were calculated to a maximum depth of 0.5 feet for sample locations from the non-navigational areas of the harbor (Slip 4, North Harbor, and Marina) or to the till surface depth, whichever depth was first encountered. A maximum depth of 2.0 feet was used for sample locations in the navigational channel (Slip 1, Inner Harbor Extension, Inner Harbor, Entrance Channel, and Outer Harbor) or to the till surface depth, whichever depth was first encountered. [The dataset used to perform the surface sediment PCB concentration calculations is the same as the dataset used to delineate the 1 ppm PCB extent using 3-dimensional (3D) interpolation.] DWA concentrations representing the surface sediment concentration from each sample location (PCB_{dwa}) were then used in the equation in step 2.

2. Where A_i is the estimated area of harbor bottom to be assigned to each sample core location. The area was determined based on polygonal declustering. This method divides the total area of influence into polygons (one for each core location), with the

polygon area representing the relative weighting of that sample. The polygons of influence, or Theissen polygons were delineated within a geographic information system (GIS) computer application, such that a polygon contains all the area that is closer to a given sample point than to any other sample point.

$$Cw_i = PCB_{dwa} \text{ x } A_i$$

3. After defining the Theissen polygons and surface sediment concentrations for each sediment sample location, the weighted concentration for each polygon (***Cw_i***) was calculated by multiplying the DWA concentration (***PCB_{dwa}***) by the area (***A_i***).
4. The products of the surface sediment concentrations and surface areas of each polygon were summed and the total divided by the total surface area for each segment to get a SWAC for the entire segment, or:

$$SWAC_{Segment} = \frac{\sum_{i=1}^{n} Cw_i}{A_{Segment}}$$

5. Once the SWACs were determined for the individual segments, a SWAC was calculated to represent the entire harbor using the equation below:

$$SWAC_{Harbor} = \frac{\sum_{r=1}^{7} SWAC_{Segment,r} \times Area_{Segment,r}}{A_{Harbor}}$$

Post-Remedial Action SWAC

The SWAC concentration representing post-remedial action conditions was initially estimated based on a DWA of sediment PCB concentrations to determine if the remedial goal of 0.2 ppm could be achieved. The estimated post-remedial action SWAC was calculated utilizing the same process from steps 2 through 5 above. Step 1 above differs in that DWA surface sediment concentrations used the following three surface components:

- A PCB concentration of a residual sand layer and/or cap with an assumed concentration of no detectable PCBs (0 ppm) throughout the entire residual sand layer and/or cap thickness .
- A PCB concentration at each sample location representative of residual sediment (resulting from dredging activities) was calculated using the DWA formula in step 1. Where PCB_{dwa} is the residual DWA concentration, PCB_i is the PCB concentration of the dredged depth interval *i*, and ΔZ_i is the length of the sample interval dredged.
- A PCB concentration at each sample location representative of the sediment remaining below the residual layer and residual sand layer/cap that is within the allowable surface sediment thickness (0.5 or 2.0 feet for non-navigational or navigational locations,

respectively) or to the till surface, whichever is encountered first. This sediment layer concentration was calculated using the DWA formula in step 1 where PCB_{dwa} is the remaining sediment DWA concentration, PCB_i is the PCB concentration of the depth interval i, and ΔZ_i is the length of the sample interval.

The PCB concentrations of the above three surface components along with their respective depth intervals was used for Steps 2 through 5, above, to form estimated DWA concentrations representing the post-remedial action surface concentration at each sample location

This same process will also be used to calculate the actual post-remedial action SWAC following its completion by using sediment core PCB data results obtained from verification sampling.

Appendix C

Detailed Cost Estimates

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 2a - Environmental Dredging and Offsite Disposal **6000**
WAUKEGAN, IL
April 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		`
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 771,418**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 32,474		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	20	MO	$ 4,000	$ 80,000		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 76,638		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	13	MO	$ 6,000	$ 76,088		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 38,968		
Site Trailer and Utilities (during T&D and winter)	22	MO	$ 3,000	$ 66,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					**$ 2,624,253**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	7,200	CY	$ 20	$ 144,000		
Geomembrane composite liner (GCL)	44,000	SY	$ 5.00	$ 220,000		Assumes no sewing of GCL seams
PVC geomembrane liner	44,000	SY	$ 8.00	$ 352,000		Assumes two 30 mil liners
Geotextile	44,000	SY	$ 2.70	$ 118,800		
Filter Stone	39,778	CY	$ 25.00	$ 994,444		
Gravel layer (6-inch)	6,630	CY	$ 22.00	$ 145,852		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe Road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					**$ 4,351,023**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (815,392)	$ (815,392)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					**$ 4,394,312**	
Geotubes	195,200	CY	$ 6.28	$ 1,225,000		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	107	DAY	$ 9,000	$ 964,467		Assumes 5 people 24 hrs/day and equipment
Sediment Polymer System Equipment Rental	3	MO	$ 19,150	$ 62,187		2008 SNF cost for Waukegan
Polymer	162,667	TON	$ 4.24	$ 688,893		Assumes 3.5 lb polymer/dry ton sediment
Chemicals/Operating Expenses	3	MO	$ 25,000	$ 81,184		
Treatment System Operations (Dredging months)	3	MO	$ 180,000	$ 584,525		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	18	MO	$ 17,000	$ 306,000		
Miscellaneous Maintenance Supplies	3	MO	$ 25,000	$ 81,184		
Discharge Monitoring and Reporting	7	MO	$ 1,500	$ 10,871		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 5,562,825**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	195	DAY	$ 24,000	$ 4,676,203		For two 8-inch dredges
Dredge Monitoring	195	DAY	$ 810	$ 157,822		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,707,433**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Residual Sand Cover	71,227	CY	$ 20	$ 1,424,540		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 9,157,606**	
Load trucks with dewatered sediment and geotubes	247,943	TON	$ 3	$ 743,830		Assumes 15,000 ton/month transported to landfill
Transport dewatered sediment to landfill	247,943	TON	$ 6	$ 1,487,661		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	247,943	TON	$ 18	$ 4,462,983		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of Dewatering Pad	85,772	TON	$ 4	$ 343,087		Assumes dewatering pad material is approx 1.6 ton/cy
Transportation and Disposal of dewatering pad material	85,772	TON	$ 24	$ 2,058,524		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					**$ 49,587**	
Grading	7	AC	$ 3,000	$ 20,661		
Topsoil and seed	7	AC	$ 4,200	$ 28,926		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 30,814,456**	
Payment/Performance Bonds and Insurance (4%)					**$ 1,232,578**	
Contractor G&A (12.7%)					**$ 4,069,973**	
Contractor Fee (5%)					**$ 1,805,850**	
					$ 37,922,857	
Contractor Professional/Technical Services					**$ 1,851,361**	
Contractor Engineering/Design (2.5%)	1	LS	$ 770,361	$ 770,361		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 225,000		
Field Project Management (T&D Operations and winter)	22	MO	$ 25,000	$ 550,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 994,355**	
Contingency (20%)					**$ 7,584,571**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 48,353,146**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 2b - Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
April 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 549,330**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 32,474		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 76,638		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 38,968		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,478,465**	
Dust Control	4	MO	$ 8,200	$ 32,800		
Clean berm construction	7,100	CY	$ 20	$ 142,000		
Geomembrane composite liner (GCL)	38,000	SY	$ 5.00	$ 190,000		Assumes no sewing of GCL seams
PVC geomembrane liner	38,000	SY	$ 8.00	$ 304,000		Assumes two 30 mil liners
Geotextile	38,000	SY	$ 2.70	$ 102,600		
Filter Stone	34,833	CY	$ 25.00	$ 870,833		
Gravel layer (6-inch)	5,806	CY	$ 22.00	$ 127,722		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	12,208	CY	$ 19.00	$ 231,952		
Fill material for cover construction (2.5-ft)	29,000	CY	$ 19.00	$ 551,000		
Top soil and seeding for cover construction (6-inch)	35,000	SY	$ 8.60	$ 301,000		
Water Treatment Construction					**$ 4,351,023**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (815,392)	$ (815,392)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					**$ 4,124,812**	
Geotubes	195,200	CY	$ 6.28	$ 1,225,000		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	107	DAY	$ 9,000	$ 964,467		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 62,187		2008 SNF cost for Waukegan
Polymer	162,667	TON	$ 4.24	$ 688,893		
Chemicals	3	MO	$ 25,000	$ 81,184		
Operations (Dredging months)	3	MO	$ 180,000	$ 584,525		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	3	MO	$ 25,000	$ 81,184		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 12,371		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 5,562,825**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	195	EA	$ 24,000	$ 4,676,203		For two 8-inch dredges
Dredge Monitoring	195	DAY	$ 810	$ 157,822		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,707,433**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Residual Sand Cover	71,227	CY	$ 20	$ 1,424,540		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 61,520**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Topsoil and seed	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 22,153,006**	
Payment/Performance Bonds and Insurance (4%)					**$ 886,120**	
Contractor G&A (12.7%)					**$ 2,925,969**	
Contractor Fee (5%)					**$ 1,298,255**	
					$ 27,263,350	
Contractor Professional/Technical Services					**$ 1,276,377**	
Contractor Engineering/Design (2.5%)	1	LS	$ 553,825	$ 553,825		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 243,552		
Field Project Management (Winter and cover)	11	MO	$ 25,000	$ 275,000		
Home Office Project Managment/Procurement	24	MO	$ 8,500	$ 204,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 713,493**	
Contingency (20%)					**$ 5,452,670**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
O&M Present Value@ 7%					**$ 156,550**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 34,862,441**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 3a - Capping of North Harbor and Slip 4, Environmental Dredging and Offsite Disposal
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 740,704**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 27,689		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	20	MO	$ 4,000	$ 80,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 65,347		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	11	MO	$ 6,000	$ 67,191		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 33,227		
Site Trailer and Utilities (during T&D and winter)	22	MO	$ 3,000	$ 66,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					**$ 2,381,516**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,900	CY	$ 20	$ 138,000		
Geomembrane composite liner (GCL)	38,000	SY	$ 5.00	$ 190,000		Assumes no sewing of GCL seams
PVC geomembrane liner	38,000	SY	$ 8.00	$ 304,000		Assumes two 30 mil liners
Geotextile	38,000	SY	$ 2.70	$ 102,600		
Filter Stone	34,806	CY	$ 25.00	$ 870,139		
Gravel layer (6-inch)	5,801	CY	$ 22.00	$ 127,620		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					**$ 4,351,023**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (815,392)	$ (815,392)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					**$ 3,883,253**	
Geotubes	169,800	CY	$ 6.28	$ 1,065,599		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	91	DAY	$ 9,000	$ 822,370		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 53,025		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	141,500	TON	$ 4.24	$ 599,253		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 69,223		
Treatment System Operations (Dredging months)	3	MO	$ 180,000	$ 498,406		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	18	MO	$ 17,000	$ 306,000		
Miscellaneous Maintenance Supplies	3	MO	$ 25,000	$ 69,223		
Discharge Monitoring and Reporting	7	MO	$ 1,500	$ 10,153		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 4,850,620**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	166	DAY	$ 24,000	$ 3,987,251		For two 8-inch dredges
Dredge Monitoring	166	DAY	$ 810	$ 134,570		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,663,813**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	3,940	CY	$ 32	$ 126,080		
Sediment cap - sand	3,248	CY	$ 20	$ 64,960		Assumes material is supplied from offsite
Residual Sand Cover	59,494	CY	$ 20	$ 1,189,880		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 8,013,180**	
Load trucks with dewatered sediment and geotubes	215,680	TON	$ 3	$ 647,041		Assumes 15,000 ton/month
Transport dewatered sediment to landfill	215,680	TON	$ 6	$ 1,294,082		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	215,680	TON	$ 18	$ 3,882,246		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of dewatering pad	76,010	TON	$ 4	$ 304,041		
Transportation and Disposal of dewatering pad material	76,010	TON	$ 24	$ 1,824,249		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					**$ 49,587**	
Grading	7	AC	$ 3,000	$ 20,661		
Topsoil and seed	7	AC	$ 4,200	$ 28,926		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 28,129,696**	
Payment/Performance Bonds and Insurance (4%)					**$ 1,125,188**	
Contractor G&A (12.7%)					**$ 3,715,370**	
Contractor Fee (5%)					**$ 1,648,513**	
					$ 34,618,767	
Contractor Professional/Technical Services					**$ 1,716,912**	
Contractor Engineering/Design (2.5%)	1	LS	$ 703,242	$ 703,242		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 207,669		
Field Project Management (T&D Operations and winter)	20	MO	$ 25,000	$ 500,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 908,392**	
Contingency (20%)					**$ 6,923,753**	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 86,308**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 44,254,132**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 3b - Capping of North Harbor and Slip 4, Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 527,513**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 27,689		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 65,347		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 33,227		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,303,201**	
Dust Control	4	MO	$ 8,200	$ 32,800		
Clean berm construction	6,800	CY	$ 20	$ 136,000		
Geomembrane composite liner (GCL)	36,000	SY	$ 5.00	$ 180,000		Assumes no sewing of GCL seams
PVC geomembrane liner	36,000	SY	$ 8.00	$ 288,000		Assumes two 30 mil liners
Geotextile	36,000	SY	$ 2.70	$ 97,200		
Filter Stone	32,817	CY	$ 25.00	$ 820,417		
Gravel layer (6-inch)	5,469	CY	$ 22.00	$ 120,328		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	10,900	CY	$ 19.00	$ 207,100		
Fill material for cover construction (2.5-ft)	27,000	CY	$ 19.00	$ 513,000		
Top soil and seeding for cover construction (6-inch)	33,000	SY	$ 8.60	$ 283,800		
Water Treatment Construction					**$ 4,351,023**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (815,392)	$ (815,392)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					**$ 3,613,753**	
Geotubes	169,800	CY	$ 6.28	$ 1,065,599		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	91	DAY	$ 9,000	$ 822,370		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 53,025		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	141,500	TON	$ 4.24	$ 599,253		
Chemicals	3	MO	$ 25,000	$ 69,223		
Operations (Dredging months)	3	MO	$ 180,000	$ 498,406		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	3	MO	$ 25,000	$ 69,223		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 11,653		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 4,850,620**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	166	DAY	$ 24,000	$ 3,987,251		For two 8-inch dredges
Dredge Monitoring	166	DAY	$ 810	$ 134,570		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,663,813**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	3,940	CY	$ 32	$ 126,080		
Sediment cap - sand	3,248	CY	$ 20	$ 64,960		Assumes material is supplied from offsite
Residual Sand Cover	59,494	CY	$ 20	$ 1,189,880		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 61,520**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of carbon and sand	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Record Drawings/Topo Information	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 20,689,043**	
Payment/Performance Bonds and Insurance (4%)					**$ 827,562**	
Contractor G&A (12.7%)					**$ 2,732,609**	
Contractor Fee (5%)					**$ 1,212,461**	
					$ 25,461,675	
Contractor Professional/Technical Services					**$ 1,530,895**	
Contractor Engineering/Design (2.5%)	1	LS	$ 517,226	$ 517,226		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 207,669		
Field Project Management (Winter and cover)	20	MO	$ 25,000	$ 500,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 674,814**	
Contingency (20%)					**$ 5,092,335**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 242,858**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 33,002,578**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 4a - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Offsite Disposal
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					$ 126,000	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					$ 705,078	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 32,474		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	16	MO	$ 4,000	$ 64,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 76,638		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	6	MO	$ 6,000	$ 37,748		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 38,968		
Site Trailer and Utilities (during T&D and winter)	18	MO	$ 3,000	$ 54,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					$ 1,853,281	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,300	CY	$ 20	$ 126,000		
Geomembrane composite liner (GCL)	26,000	SY	$ 5.00	$ 130,000		Assumes no sewing of GCL seams
PVC geomembrane liner	26,000	SY	$ 8.00	$ 208,000		Assumes two 30 mil liners
Geotextile	26,000	SY	$ 2.70	$ 70,200		
Filter Stone	23,369	CY	$ 25.00	$ 584,236		
Gravel layer (6-inch)	3,895	CY	$ 22.00	$ 85,688		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					$ 2,391,528	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 714,350	$ 714,350		Based on vendor quote
Filtration	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Carbon Adsorption	1	LS	$ 265,386	$ 265,386		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 117,269	$ 117,269		Based on vendor quote
Water Treatment Piping	1	LS	$ 240,769	$ 240,769		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 377,431	$ 377,431		Based on vendor quote
Tank Installation	1	LS	$ 7,692	$ 7,692		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 20,264	$ 20,264		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 55,000	$ 55,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (435,035)	$ (435,035)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					$ 3,198,671	
Geotubes	111,500	CY	$ 6.28	$ 699,731		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	87	DAY	$ 9,000	$ 781,437		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	6	MO	$ 19,150	$ 114,900		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	92,917	TON	$ 4.24	$ 393,502		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 65,778		
Treatment System Operations (Dredging months)	3	MO	$ 180,000	$ 473,598		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	12	MO	$ 17,000	$ 204,000		
Miscellaneous Maintenance Supplies	3	MO	$ 25,000	$ 65,778		
Discharge Monitoring and Reporting	7	MO	$ 1,500	$ 9,947		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					$ 800,000	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					$ 1,549,933	
Mobilization	1	LS	$ 300,000	$ 300,000		For one 8-inch dredge
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	79	DAY	$ 12,000	$ 947,197		For one 8-inch dredge
Dredge Monitoring	79	DAY	$ 810	$ 63,936		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					$ 3,416,987	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	9,162	CY	$ 32	$ 293,184		
Sediment cap - sand	7,713	CY	$ 20	$ 154,260		Assumes material is supplied from offsite
Armored Sediment Cap - armor stone	13,086	CY	$ 40	$ 523,440		
Armored Sediment Cap - filter stone	4,674	CY	$ 35	$ 163,590		
Armored Sediment Cap - sand	3,739	CY	$ 20	$ 74,780		Assumes material is supplied from offsite
Residual Sand Cover	46,242	CY	$ 20	$ 924,840		Assumes material is supplied from offsite
Transporation and Disposal Offsite					$ 4,575,866	
Load trucks with dewatered sediment and geotubes	111,719	TON	$ 3	$ 335,158		Assumes 15,000 ton/month
Transport dewatered sediment to landfill	111,719	TON	$ 6	$ 670,316		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	111,719	TON	$ 18	$ 2,010,949		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of dewatering pad	53,703	TON	$ 4	$ 214,812		
Transportation and Disposal of dewatering pad material	53,703	TON	$ 24	$ 1,288,871		
Transportation and Disposal of Carbon/Sand Media to Landfill	240	TON	$ 24	$ 5,760		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					$ 49,587	
Grading	7	AC	$ 3,000	$ 20,661		
Record Drawings/Topo Information	7	AC	$ 4,200	$ 28,926		
Demobilize					$ 270,000	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					$ 18,936,930	
Payment/Performance Bonds and Insurance (4%)					$ 757,477	
Contractor G&A (12.7%)					$ 2,501,190	
Contractor Fee (5%)					$ 1,109,780	
					$ 23,305,377	
Contractor Professional/Technical Services					$ 1,274,756	
Contractor Engineering/Design (2.5%)	1	LS	$ 473,423	$ 473,423		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 197,333		
Field Project Management (T&D Operations and winter)	16	MO	$ 25,000	$ 400,000		
Home Office Project Managment/Procurement	24	MO	$ 8,500	$ 204,000		
Contractor Program Management						
Program Management Oversight (2.5%)					$ 614,503	
Contingency (20%)					$ 4,661,075	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					$ 86,308	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					$ 29,942,020	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 4b - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 538,050**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 30,000		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 70,800		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities	3	MO	$ 12,000	$ 36,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,195,593**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,800	CY	$ 20	$ 136,000		
Geomembrane composite liner (GCL)	36,000	SY	$ 5.00	$ 180,000		Assumes no sewing of GCL seams
PVC geomembrane liner	36,000	SY	$ 8.00	$ 288,000		Assumes two 30 mil liners
Geotextile	36,000	SY	$ 2.70	$ 97,200		
Filter Stone	32,817	CY	$ 25.00	$ 820,417		
Gravel layer (6-inch)	5,469	CY	$ 22.00	$ 120,328		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	5,668	CY	$ 19.00	$ 107,692		
Fill material for cover construction (2.5-ft)	27,000	CY	$ 19.00	$ 513,000		
Top soil for cover construction (6-inch)	33,000	SY	$ 8.60	$ 283,800		
Water Treatment Construction					**$ 2,391,528**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 714,350	$ 714,350		Based on vendor quote
Filtration	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Carbon Adsorption	1	LS	$ 265,386	$ 265,386		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 117,269	$ 117,269		Based on vendor quote
Water Treatment Piping	1	LS	$ 240,769	$ 240,769		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 377,431	$ 377,431		Based on vendor quote
Tank Installation	1	LS	$ 7,692	$ 7,692		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 20,264	$ 20,264		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 55,000	$ 55,000		Based on vendor quote and Includes chemical (polymer)
Salvage Value	1	LS	$ (435,035)	$ (435,035)		Assumes $0.25 salvage value per $1.00 for equipment
Dewatering Operation					**$ 2,966,656**	
Geotubes	111,500	CY	$ 6.28	$ 699,731		
Mobilization	1	LS	$ 250,000	$ 250,000		Assumes 5 people 24 hrs/day and equipment
Geotube Dewatering Operation	87	DAY	$ 9,000	$ 781,437		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 50,386		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	92,917	TON	$ 4.24	$ 393,502		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 65,778		
Operations (Dredging months)	3	MO	$ 180,000	$ 473,598		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	3	MO	$ 25,000	$ 65,778		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 11,447		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 1,549,933**	
Mobilization	1	LS	$ 300,000	$ 300,000		For one 8-inch dredge
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	79	DAY	$ 12,000	$ 947,197		For one 8-inch dredge
Dredge Monitoring	79	DAY	$ 810	$ 63,936		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 3,416,987**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	9,162	CY	$ 32	$ 293,184		
Sediment cap - sand	7,713	CY	$ 20	$ 154,260		Assumes material is supplied from offsite
Armored Sediment Cap - armor stone	13,086	CY	$ 40	$ 523,440		
Armored Sediment Cap - filter stone	4,674	CY	$ 35	$ 163,590		
Armored Sediment Cap - sand	3,739	CY	$ 20	$ 74,780		Assumes material is supplied from offsite
Residual Sand Cover	46,242	CY	$ 20	$ 924,840		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 55,760**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of Carbon/Sand Media to Landfill	240	TON	$ 24	$ 5,760		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Record Drawings/Topo Information	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 15,432,107**	
Payment/Performance Bonds and Insurance (4%)					**$ 617,284**	
Contractor G&A (12.7%)					**$ 2,038,273**	
Contractor Fee (5%)					**$ 904,383**	
					$ 18,992,047	
Contractor Professional/Technical Services					**$ 878,135**	
Contractor Engineering/Design (2.5%)	1	LS	$ 385,803	$ 385,803		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 197,333		
Field Project Management (Winter and cover)	5	MO	$ 25,000	$ 125,000		
Home Office Project Managment/Procurement	20	MO	$ 8,500	$ 170,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 496,755**	
Contingency (20%)					**$ 3,798,409**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 242,858**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 24,408,205**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 5 - Capping
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 71,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Submittals	1	LS	$ 35,000	$ 35,000		
Setup of Temporary Facilities					**$ 454,000**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	1900	LF	$ 50	$ 95,000		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road	3	MO	$ 10,000	$ 30,000		
Miscellaneous storage facilities, equipment, supplies	3	LS	$ 50,000	$ 150,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities	6	MO	$ 3,500	$ 21,000		
Electrical Drop	3	LS	$ 25,000	$ 75,000		
Temporary Dewatering Pad Construction					**$ 275,000**	
Dewatering Pad/Jersey Barriers	1	LS	$ 200,000	$ 200,000		Jersey Barrier Berm & 40 Mil HDPE Liner
Pumps/Operating Controls	1	LS	$ 75,000	$ 75,000		
Water Treatment Construction					**$ 171,000**	
Frac Tank Storage	3	MO	$ 10,000	$ 30,000		
Treatment System Rental	3	MO	$ 47,000	$ 141,000		Based on 1000 gpm system rental
Dewatering Operation					**$ 305,848**	
Geotubes	13,000	CY	$ 6.28	$ 81,583		
Operations (Dredging months)	18	DAY	$ 6,000	$ 108,333		Assumes 720 cy/day
Polymer System Equipment Rental	1	MO	$ 19,150	$ 19,150		2008 SNF cost for Waukegan
Polymer	10,833	TON	$ 4.24	$ 45,879		Assumes 3.5 lb polymer/dry ton sediment
Miscellaneous maintenance supplies	1	LS	$ 50,000	$ 50,000		
Discharge Monitoring and Reporting	1	MO	$ 1,500	$ 903		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 396,667**	
Mobilization	1	LS	$ 150,000	$ 150,000		
Dredging	18	DAY	$ 12,000	$ 216,667		Sediment shallower than 12 ft LWD removed for placement of cap.
Bathometric Survey	2	EA	$ 15,000	$ 30,000		
In Situ Cap/Cover Placement					**$ 3,101,421**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	37,005	CY	$ 32	$ 1,184,158		
Sediment cap - sand	31,719	CY	$ 20	$ 634,370		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 149,415**	
Load trucks with dewatered sediment and geotubes	16,513	TON	$ 3	$ 49,538		
Transport dewatered sediment to landfill	16,513	TON	$ 6	$ 99,076		Estimate from Zion landfill
Transportation and Disposal of Carbon/Sand Media to Landfill	45	TON	$ 18	$ 801		Assumes 2 sand vessels @14,500 lb each and 3 carbon systems @ 20,000 lb each
Surface Restoration					**$ 14,400**	
Grading	2	AC	$ 3,000	$ 6,000		
Topsoil and seed	2	AC	$ 4,200	$ 8,400		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 6,008,751**	
Payment/Performance Bonds and Insurance (4%)					**$ 240,350**	
Contractor G&A (12.7%)					**$ 793,636**	
Contractor Fee (5%)					**$ 352,137**	
					$ 7,394,874	
Contractor Professional/Technical Services					**$ 477,219**	
Contractor Engineering/Design (2.5%)	1	LS	$ 150,219	$ 150,219		
Field Project Management (Dredging Operations)	1	MO	$ 75,000	$ 75,000		
Field Project Management (T&D Operations and winter)	6	MO	$ 25,000	$ 150,000		
Home Office Project Managment/Procurement	12	MO	$ 8,500	$ 102,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 196,802**	
Contingency (20%)					**$ 1,478,975**	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 86,308**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 9,634,178**	

Appendix D

Alternative Dilution Based Limits

Review of Great Lakes Water Quality Limits Waukegan Harbor Area of Concern

TO: Keli McKenna/MKE

COPIES: Cynthia Cruciani/MKE
Mike Jury/MKE

FROM: Jennifer Byrd/MKE
Tom Dupuis/BOI

DATE: March 28, 2008

Introduction

CH2M Hill developed a *Preliminary Design Document, Waukegan Harbor Area of Concern, Waukegan, Illinois* ("PDD") for the US EPA in November 2005. As part of this process, CH2M Hill requested preliminary effluent requirements from the Illinois EPA (IEPA) for discharge to Waukegan Harbor (e.g., potential effluent limits). IEPA provided a list of effluent limits for a harbor discharge in a memorandum dated February 26, 2006. These potential effluent limits were derived directly from Illinois water quality criteria, with no allowance for dilution in the harbor.

This memorandum provides a review of the applicable regulations and discusses the major factors affecting water quality in the harbor. Where applicable, alternative dilution based limits are proposed. An ammonia mass balance in the harbor at project completion is also presented.

Regulatory Review

Water quality criteria specific to the Lake Michigan basin are outlined in 35 IL Admin Code § 302, Subpart E. Most criteria apply to any waters of the Lake Michigan basin, including Waukegan Harbor. For certain chemical constituents, such as ammonia, more restrictive limits are in place for discharges directly to open waters of Lake Michigan. These criteria are documented in the accompanying Microsoft Excel spreadsheet, GLWQ.xls (Attachment A). Some of the criteria vary based on other parameters in the receiving water, such as hardness, pH, and temperature. Values for these parameters have been assumed based upon available water quality data.

Section 302.102 states that "Whenever a water quality standard is more restrictive than its corresponding effluent standard, or where there is no corresponding effluent standard specified at 35 Ill. Adm. Code 304, an opportunity shall be allowed for compliance with 35 Ill. Adm. Code 304.105 by mixture of an effluent with its receiving waters, provided the discharger has made to comply every effort with the requirements of 35 Ill. Adm. Code." This provision does not apply to chemicals which are known to bioaccumulate (BCCs), such as mercury and PCBs.

Using guidance from 302.102, dilution based limits are presented in Attachment A when appropriate.

Limit Calculations

The continual exchange of water between the lake and harbor, caused by wind-induced seiches, prevents stagnation of the harbor water. Average wind-induced currents in and out of the harbor exchange the volume of water in the harbor in one to eight days and provide mixing and dilution for discharged constituents (US EPA, 1999a).

Bathymetric data for the harbor was used to determine water volumes available for dilution within the harbor. Two zones were considered; the entire harbor volume for calculating limits for chronic aquatic life and human health criteria and the volume within the North Harbor as the Zone of Initial Dilution (ZID) in calculating limits for acute aquatic life criteria. The additional dilution provided by seiche-induced turnover in the harbor was considered separately. Turnover in the harbor was conservatively assumed to occur in 8 days. A mass balance was then used to calculate dilution-based limits. This calculation assumed that constituent concentrations in the harbor were zero.

Ammonia Mass Balance

To further assess the impact of ammonia on the harbor, a mass balance was performed to calculate the average unionized ammonia concentration (as N) in the harbor at project completion. Background ammonia concentrations in the harbor were considered in this calculation. With a discharge rate of 2500 gpm, the final concentration was 0.46 mg/L. This calculation does not account for the natural decay of ammonia that occurs in receiving waters. Thus, actual harbor concentrations will likely be lower.

Effect on Harbor Fish

Fish samples have been collected from Waukegan Harbor (Station Code QZO-01) on an annual basis under the Illinois Fish Contaminant Monitoring Program program since 1996 (with the exception of 2002). The fish are collected by the Illinois Department of Natural Resources (IDNR) and tested by IEPA. Fish identified in large numbers in the harbor as part of this program were yellow perch, pumpkinseed, rock bass, largemouth bass, sunfish, carp and white suckers. A small number of brown trout and chinook and coho salmon were also identified; however, they were only seen during the October sampling period.

The USEPA (1999b) published genus mean chronic values (GMCV) for lepomis (includes sunfish and pumpkin seed) of 2.85 mg N/L when early life stages are present and 8.78 mg N/L when not present. Similarly the GMCV for genus Micropterus, which includes bass, is 4.56 when early life stages are present and 9.55 mg N/L when not present. These chronic values suggest that the fish species prevalent in the harbor are more tolerant of ammonia than the species of aquatic life that drove the derivation of the overall chronic criteria.

Review of Mercury Limits in other Great Lakes States

Ohio EPA estimates that the cost to remove mercury to below 12 ng/L using end of pipe treatment to be in excess of ten million dollars per pound of mercury. A number of Great Lakes states have adopted variances to address the difficulty associated with meeting stringent Great lakes Initiative mercury criteria. For example, Ohio allows a general variance for mercury, in

(D) (100) of rule 3745-33-07 of the Administrative Code. Wisconsin also allows variances, emphasizing pollution minimization programs (PMPs) as a condition of obtaining variances to mercury water quality limits (NR 106.145, Wis. Adm. Code).

Conclusions

When dilution and seiche influences are considered for the harbor, the average harbor ammonia concentration will be well below the applicable acute criteria, and also below chronic criteria at a discharge flow of 2500 gpm. In addition, the estimated average concentration is less than the GMCV for fish commonly found in the harbor and would be unlikely to result in deleterious effects on these harbor fish.

Treatment for mercury to the levels presented in the limits would be difficult to achieve and make dredging a less cost-effective treatment option. Other Great Lakes states have established variances to the mercury limit for situations where treatment is not technically or economically feasible. For the proposed project, application of a similar variance concept may be appropriate. Estimated mercury discharge concentrations are greater than the proposed mercury limit, but are well below the proposed acute not-to-exceed limit. In addition, the short duration of the project will result in a small overall mass of mercury discharged to the harbor.

References

Illinois Water Quality Standards, 35 IL Admin Code § 302.

Ohio Mercury Variance Guidance (2000). Available online at : http://www.epa.state.oh.us/dsw/guidance/permit10.pdf

Ohio Water Quality Standards, Chapter 3745-1 of the ADMINISTRATIVE CODE (Effective October 5, 2007).

Wisconsin Water Quality Standards, NR 106.145, Wis. Adm. Code.

USEPA, 1999a. Record of Decision, Remedial Action, Outboard Marine Company/Waukegan Coke Plant Superfund Site, Waukegan, Illinois. September.

USEPA, 1999b. Update of Ambient Water Quality Criteria for Ammonia. EPA-822-R-99-014. December.

Mass Balance in the Harbor	Ammonia (as N) (mg/L)	
Background Harbor Concentration	0.5	Based on baseline sample collected with the site water samples from behind commercial vessel.
Background Lake Concentration	0.02	The criterion for Open Waters of Lake Michigan
Average Discharged Concentration	5.2	
Harbor Volume (cy)	1,526,011	
Seiche Inflow Volume (8-day turnover) (cy)	25,751,429	

	Alternative 2	Alternative 3	Alternative 4
Days of Operation	135	116	71

			Average Harbor Concentration at Project Completion (mg/L)	
			Ammonia	
	Discharge Rate (gpm)	*Discharge Volume (cy)*	*with no seiche influence*	*with 8-day seiche turnover*
Alternative 2	2500	2,406,250	3.38	0.46
Alternative 3	2500	2,067,593	3.20	0.41
Alternative 4	1200	607,445	1.84	0.16

Appendix E

Detail Cost Estimate for Additional Sediment to -23 feet LWD

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 2a - Environmental Dredging and Offsite Disposal **6000**
WAUKEGAN, IL
April 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		`
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 802,794**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	4	MO	$ 10,000	$ 37,534		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	20	MO	$ 4,000	$ 80,000		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	4	MO	$ 23,600	$ 88,580		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	14	MO	$ 6,000	$ 84,390		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	4	MO	$ 12,000	$ 45,041		
Site Trailer and Utilities (during T&D and winter)	22	MO	$ 3,000	$ 66,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					**$ 2,624,253**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	7,200	CY	$ 20	$ 144,000		
Geomembrane composite liner (GCL)	44,000	SY	$ 5.00	$ 220,000		Assumes no sewing of GCL seams
PVC geomembrane liner	44,000	SY	$ 8.00	$ 352,000		Assumes two 30 mil liners
Geotextile	44,000	SY	$ 2.70	$ 118,800		
Filter Stone	39,778	CY	$ 25.00	$ 994,444		
Gravel layer (6-inch)	6,630	CY	$ 22.00	$ 145,852		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe Road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					**$ 5,166,414**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					**$ 4,953,395**	
Geotubes	223,957	CY	$ 6.28	$ 1,405,468		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	124	DAY	$ 9,000	$ 1,114,758		Assumes 5 people 24 hrs/day and equipment
Sediment Polymer System Equipment Rental	4	MO	$ 19,150	$ 71,877		2008 SNF cost for Waukegan
Polymer	186,631	TON	$ 4.24	$ 790,382		Assumes 3.5 lb polymer/dry ton sediment
Chemicals/Operating Expenses	4	MO	$ 25,000	$ 93,835		
Treatment System Operations (Dredging months)	4	MO	$ 180,000	$ 675,611		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	18	MO	$ 17,000	$ 306,000		
Miscellaneous Maintenance Supplies	4	MO	$ 25,000	$ 93,835		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 11,630		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 6,316,102**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	225	DAY	$ 24,000	$ 5,404,887		For two 8-inch dredges
Dredge Monitoring	225	DAY	$ 810	$ 182,415		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,707,433**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Residual Sand Cover	71,227	CY	$ 20	$ 1,424,540		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 10,143,840**	
Load trucks with dewatered sediment and geotubes	284,471	TON	$ 3	$ 853,412		Assumes 15,000 ton/month transported to landfill
Transport dewatered sediment to landfill	284,471	TON	$ 6	$ 1,706,824		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	284,471	TON	$ 18	$ 5,120,472		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of Dewatering Pad	85,772	TON	$ 4	$ 343,087		Assumes dewatering pad material is approx 1.6 ton/cy
Transportation and Disposal of dewatering pad material	85,772	TON	$ 24	$ 2,058,524		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					**$ 49,587**	
Grading	7	AC	$ 3,000	$ 20,661		
Topsoil and seed	7	AC	$ 4,200	$ 28,926		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 33,959,819**	
Payment/Performance Bonds and Insurance (4%)					**$ 1,358,393**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 4,485,413**	
Contractor Fee (5%)					**$ 1,990,181**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 41,793,806	
Contractor Professional/Technical Services					**$ 1,986,500**	
Contractor Engineering/Design (2.5%)	1	LS	$ 848,995	$ 848,995		
Field Project Management (Dredging Operations)	4	MO	$ 75,000	$ 281,505		
Field Project Management (T&D Operations and winter)	22	MO	$ 25,000	$ 550,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 1,094,508**	
Contingency (20%)					**$ 8,358,761**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 53,233,575**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 2b - Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
April 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 572,405**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	4	MO	$ 10,000	$ 37,534		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	4	MO	$ 23,600	$ 88,580		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	4	MO	$ 12,000	$ 45,041		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,478,465**	
Dust Control	4	MO	$ 8,200	$ 32,800		
Clean berm construction	7,100	CY	$ 20	$ 142,000		
Geomembrane composite liner (GCL)	38,000	SY	$ 5.00	$ 190,000		Assumes no sewing of GCL seams
PVC geomembrane liner	38,000	SY	$ 8.00	$ 304,000		Assumes two 30 mil liners
Geotextile	38,000	SY	$ 2.70	$ 102,600		
Filter Stone	34,833	CY	$ 25.00	$ 870,833		
Gravel layer (6-inch)	5,806	CY	$ 22.00	$ 127,722		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	12,208	CY	$ 19.00	$ 231,952		
Fill material for cover construction (2.5-ft)	29,000	CY	$ 19.00	$ 551,000		
Top soil and seeding for cover construction (6-inch)	35,000	SY	$ 8.60	$ 301,000		
Water Treatment Construction					**$ 5,166,414**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					**$ 4,683,895**	
Geotubes	223,957	CY	$ 6.28	$ 1,405,468		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	124	DAY	$ 9,000	$ 1,114,758		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	4	MO	$ 19,150	$ 71,877		2008 SNF cost for Waukegan
Polymer	186,631	TON	$ 4.24	$ 790,382		
Chemicals	4	MO	$ 25,000	$ 93,835		
Operations (Dredging months)	4	MO	$ 180,000	$ 675,611		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	4	MO	$ 25,000	$ 93,835		
Discharge Monitoring and Reporting	9	MO	$ 1,500	$ 13,130		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 6,316,102**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	225	EA	$ 24,000	$ 5,404,887		For two 8-inch dredges
Dredge Monitoring	225	DAY	$ 810	$ 182,415		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,707,433**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Residual Sand Cover	71,227	CY	$ 20	$ 1,424,540		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 61,520**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Topsoil and seed	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 24,303,834**	
Payment/Performance Bonds and Insurance (4%)					**$ 972,153**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 3,210,050**	
Contractor Fee (5%)					**$ 1,424,302**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 29,910,339	
Contractor Professional/Technical Services					**$ 1,368,100**	
Contractor Engineering/Design (2.5%)	1	LS	$ 607,596	$ 607,596		
Field Project Management (Dredging Operations)	4	MO	$ 75,000	$ 281,505		
Field Project Management (Winter and cover)	11	MO	$ 25,000	$ 275,000		
Home Office Project Managment/Procurement	24	MO	$ 8,500	$ 204,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 781,961**	
Contingency (20%)					**$ 5,982,068**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
O&M Present Value@ 7%					**$ 156,550**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 38,199,019**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 3a - Capping of North Harbor and Slip 4, Environmental Dredging and Offsite Disposal
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					$ 126,000	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					$ 772,081	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 32,750		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	20	MO	$ 4,000	$ 80,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 77,289		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	13	MO	$ 6,000	$ 75,493		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 39,299		
Site Trailer and Utilities (during T&D and winter)	22	MO	$ 3,000	$ 66,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					$ 2,381,516	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,900	CY	$ 20	$ 138,000		
Geomembrane composite liner (GCL)	38,000	SY	$ 5.00	$ 190,000		Assumes no sewing of GCL seams
PVC geomembrane liner	38,000	SY	$ 8.00	$ 304,000		Assumes two 30 mil liners
Geotextile	38,000	SY	$ 2.70	$ 102,600		
Filter Stone	34,806	CY	$ 25.00	$ 870,139		
Gravel layer (6-inch)	5,801	CY	$ 22.00	$ 127,620		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					$ 5,166,414	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					$ 4,442,337	
Geotubes	198,557	CY	$ 6.28	$ 1,246,067		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	108	DAY	$ 9,000	$ 972,662		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 62,715		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	165,464	TON	$ 4.24	$ 700,741		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 81,874		
Treatment System Operations (Dredging months)	3	MO	$ 180,000	$ 589,492		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	18	MO	$ 17,000	$ 306,000		
Miscellaneous Maintenance Supplies	3	MO	$ 25,000	$ 81,874		
Discharge Monitoring and Reporting	7	MO	$ 1,500	$ 10,912		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					$ 800,000	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					$ 5,603,898	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	196	DAY	$ 24,000	$ 4,715,935		For two 8-inch dredges
Dredge Monitoring	196	DAY	$ 810	$ 159,163		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					$ 2,663,813	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	3,940	CY	$ 32	$ 126,080		
Sediment cap - sand	3,248	CY	$ 20	$ 64,960		Assumes material is supplied from offsite
Residual Sand Cover	59,494	CY	$ 20	$ 1,189,880		Assumes material is supplied from offsite
Transporation and Disposal Offsite					$ 8,999,414	
Load trucks with dewatered sediment and geotubes	252,208	TON	$ 3	$ 756,623		Assumes 15,000 ton/month
Transport dewatered sediment to landfill	252,208	TON	$ 6	$ 1,513,245		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	252,208	TON	$ 18	$ 4,539,736		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of dewatering pad	76,010	TON	$ 4	$ 304,041		
Transportation and Disposal of dewatering pad material	76,010	TON	$ 24	$ 1,824,249		
Transportation and Disposal of Carbon/Sand Media to Landfill	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					$ 49,587	
Grading	7	AC	$ 3,000	$ 20,661		
Topsoil and seed	7	AC	$ 4,200	$ 28,926		
Demobilize					$ 270,000	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					$ 31,275,060	
Payment/Performance Bonds and Insurance (4%)					$ 1,251,002	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					$ 4,130,810	
Contractor Fee (5%)					$ 1,832,844	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 38,489,716	
Contractor Professional/Technical Services					$ 1,833,498	
Contractor Engineering/Design (2.5%)	1	LS	$ 781,876	$ 781,876		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 245,622		
Field Project Management (T&D Operations and winter)	20	MO	$ 25,000	$ 500,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					$ 1,008,080	
Contingency (20%)					$ 7,697,943	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					$ 86,308	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					$ 49,115,545	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 3b - Capping of North Harbor and Slip 4, Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 550,588**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 32,750		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property	3	MO	$ 23,600	$ 77,289		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 39,299		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,303,201**	
Dust Control	4	MO	$ 8,200	$ 32,800		
Clean berm construction	6,800	CY	$ 20	$ 136,000		
Geomembrane composite liner (GCL)	36,000	SY	$ 5.00	$ 180,000		Assumes no sewing of GCL seams
PVC geomembrane liner	36,000	SY	$ 8.00	$ 288,000		Assumes two 30 mil liners
Geotextile	36,000	SY	$ 2.70	$ 97,200		
Filter Stone	32,817	CY	$ 25.00	$ 820,417		
Gravel layer (6-inch)	5,469	CY	$ 22.00	$ 120,328		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	10,900	CY	$ 19.00	$ 207,100		
Fill material for cover construction (2.5-ft)	27,000	CY	$ 19.00	$ 513,000		
Top soil and seeding for cover construction (6-inch)	33,000	SY	$ 8.60	$ 283,800		
Water Treatment Construction					**$ 5,166,414**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 1,439,620	$ 1,439,620		Based on vendor quote
Filtration	1	LS	$ 1,061,544	$ 1,061,544		Based on vendor quote
Carbon Adsorption	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 234,537	$ 234,537		Based on vendor quote
Water Treatment Piping	1	LS	$ 481,538	$ 481,538		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 754,862	$ 754,862		Based on vendor quote
Tank Installation	1	LS	$ 15,384	$ 15,384		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 40,527	$ 40,527		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 110,000	$ 110,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					**$ 4,172,837**	
Geotubes	198,557	CY	$ 6.28	$ 1,246,067		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	108	DAY	$ 9,000	$ 972,662		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 62,715		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	165,464	TON	$ 4.24	$ 700,741		
Chemicals	3	MO	$ 25,000	$ 81,874		
Operations (Dredging months)	3	MO	$ 180,000	$ 589,492		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	3	MO	$ 25,000	$ 81,874		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 12,412		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 5,603,898**	
Mobilization	1	LS	$ 490,000	$ 490,000		For two 8-inch dredges
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	196	DAY	$ 24,000	$ 4,715,935		For two 8-inch dredges
Dredge Monitoring	196	DAY	$ 810	$ 159,163		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 2,663,813**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	3,940	CY	$ 32	$ 126,080		
Sediment cap - sand	3,248	CY	$ 20	$ 64,960		Assumes material is supplied from offsite
Residual Sand Cover	59,494	CY	$ 20	$ 1,189,880		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 61,520**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of carbon and sand	480	TON	$ 24	$ 11,520		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Record Drawings/Topo Information	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 22,839,871**	
Payment/Performance Bonds and Insurance (4%)					**$ 913,595**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 3,016,690**	
Contractor Fee (5%)					**$ 1,338,508**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 28,108,664	
Contractor Professional/Technical Services					**$ 1,622,618**	
Contractor Engineering/Design (2.5%)	1	LS	$ 570,997	$ 570,997		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 245,622		
Field Project Management (Winter and cover)	20	MO	$ 25,000	$ 500,000		
Home Office Project Managment/Procurement	36	MO	$ 8,500	$ 306,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 743,282**	
Contingency (20%)					**$ 5,621,733**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 242,858**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 36,339,155**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 4a - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Offsite Disposal
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 724,506**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 34,914		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Maintain haul road/access road (during T&D and winter)	16	MO	$ 4,000	$ 64,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 82,396		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Traffic control for trucks entering OMC property (during T&D)	8	MO	$ 6,000	$ 46,050		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 50hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1000	FT	$ 11	$ 11,000		
Site Trailer and Utilities (during dredging)	3	MO	$ 12,000	$ 41,896		
Site Trailer and Utilities (during T&D and winter)	18	MO	$ 3,000	$ 54,000		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Temporary Dewatering Pad Construction					**$ 1,853,281**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,300	CY	$ 20	$ 126,000		
Geomembrane composite liner (GCL)	26,000	SY	$ 5.00	$ 130,000		Assumes no sewing of GCL seams
PVC geomembrane liner	26,000	SY	$ 8.00	$ 208,000		Assumes two 30 mil liners
Geotextile	26,000	SY	$ 2.70	$ 70,200		
Filter Stone	23,369	CY	$ 25.00	$ 584,236		
Gravel layer (6-inch)	3,895	CY	$ 22.00	$ 85,688		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Water Treatment Construction					**$ 2,826,562**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 714,350	$ 714,350		Based on vendor quote
Filtration	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Carbon Adsorption	1	LS	$ 265,386	$ 265,386		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 117,269	$ 117,269		Based on vendor quote
Water Treatment Piping	1	LS	$ 240,769	$ 240,769		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 377,431	$ 377,431		Based on vendor quote
Tank Installation	1	LS	$ 7,692	$ 7,692		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 20,264	$ 20,264		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 55,000	$ 55,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					**$ 3,887,230**	
Geotubes	140,257	CY	$ 6.28	$ 880,199		
Mobilization	1	LS	$ 250,000	$ 250,000		
Geotube Dewatering Operation	115	DAY	$ 9,000	$ 1,036,932		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 66,859		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	116,881	TON	$ 4.24	$ 494,990		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 87,284		
Treatment System Operations (Dredging months)	3	MO	$ 180,000	$ 628,444		Assumes WTP Operation 30 days per month/$6000 per day
Treatment System Operations (Winter months)	4	MO	$ 35,000	$ 140,000		
Treatment System Operations (T&D Operations)	12	MO	$ 17,000	$ 204,000		
Miscellaneous Maintenance Supplies	3	MO	$ 25,000	$ 87,284		
Discharge Monitoring and Reporting	7	MO	$ 1,500	$ 11,237		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 1,880,528**	
Mobilization	1	LS	$ 300,000	$ 300,000		For one 8-inch dredge
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	105	DAY	$ 12,000	$ 1,256,888		For one 8-inch dredge
Dredge Monitoring	105	DAY	$ 810	$ 84,840		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 3,416,987**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	9,162	CY	$ 32	$ 293,184		
Sediment cap - sand	7,713	CY	$ 20	$ 154,260		Assumes material is supplied from offsite
Armored Sediment Cap - armor stone	13,086	CY	$ 40	$ 523,440		
Armored Sediment Cap - filter stone	4,674	CY	$ 35	$ 163,590		
Armored Sediment Cap - sand	3,739	CY	$ 20	$ 74,780		Assumes material is supplied from offsite
Residual Sand Cover	46,242	CY	$ 20	$ 924,840		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 5,562,101**	
Load trucks with dewatered sediment and geotubes	148,247	TON	$ 3	$ 444,740		Assumes 15,000 ton/month
Transport dewatered sediment to landfill	148,247	TON	$ 6	$ 889,479		Estimate from Zion landfill
Dispose of dewatered sediment at landfill	148,247	TON	$ 18	$ 2,668,438		Estimate from Zion landfill
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Demo of dewatering pad	53,703	TON	$ 4	$ 214,812		
Transportation and Disposal of dewatering pad material	53,703	TON	$ 24	$ 1,288,871		
Transportation and Disposal of Carbon/Sand Media to Landfill	240	TON	$ 24	$ 5,760		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Surface Restoration					**$ 49,587**	
Grading	7	AC	$ 3,000	$ 20,661		
Record Drawings/Topo Information	7	AC	$ 4,200	$ 28,926		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 21,396,781**	
Payment/Performance Bonds and Insurance (4%)					**$ 855,871**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 2,826,087**	
Contractor Fee (5%)					**$ 1,253,937**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 26,332,675	
Contractor Professional/Technical Services					**$ 1,400,771**	
Contractor Engineering/Design (2.5%)	1	LS	$ 534,920	$ 534,920		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 261,852		
Field Project Management (T&D Operations and winter)	16	MO	$ 25,000	$ 400,000		
Home Office Project Managment/Procurement	24	MO	$ 8,500	$ 204,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 693,336**	
Contingency (20%)					**$ 5,266,535**	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 86,308**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 33,779,626**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 4b - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Onsite Consolidation
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 126,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Panel layouts/geosynthetic conformance testing	1	LS	$ 20,000	$ 20,000		
Submittals	1	LS	$ 70,000	$ 70,000		
Setup of Temporary Facilities					**$ 560,456**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	3875	LF	$ 50	$ 193,750		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road (during dredging)	3	MO	$ 10,000	$ 34,914		Assumes Stone Replacement Monthly with perdiodic re-grading with a 14G
Traffic control signage	1	LS	$ 3,000	$ 3,000		
Traffic control for trucks entering OMC property (during dredging)	3	MO	$ 23,600	$ 82,396		Full Time Security Guard @ 24 days x 10 hours per day ($30/hr x 168hrs/wk x 4 wks)/Add Vehicle
Construction survey crew	3	MO	$ 5,500	$ 16,500		Est. 4 days/month @ $1,000/day/Plus Office Time to Evaluate Data
Geotechnical CQC services/On-site lab	2	MO	$ 15,000	$ 30,000		During the construction
Miscellaneous storage facilities, equipment, supplies	1	LS	$ 50,000	$ 50,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities	3	MO	$ 12,000	$ 41,896		
Electrical Drop	1	LS	$ 25,000	$ 25,000		
Consolidation Cell Construction					**$ 3,195,593**	
Dust Control	3	MO	$ 8,200	$ 24,600		
Clean berm construction	6,800	CY	$ 20	$ 136,000		
Geomembrane composite liner (GCL)	36,000	SY	$ 5.00	$ 180,000		Assumes no sewing of GCL seams
PVC geomembrane liner	36,000	SY	$ 8.00	$ 288,000		Assumes two 30 mil liners
Geotextile	36,000	SY	$ 2.70	$ 97,200		
Filter Stone	32,817	CY	$ 25.00	$ 820,417		
Gravel layer (6-inch)	5,469	CY	$ 22.00	$ 120,328		
Sump	1	LS	$ 7,000	$ 7,000		
Water collection piping (16-inch PVC)	1,300	LF	$ 114	$ 148,200		Includes piping within pad and to the treatment system
Access ramp	1	LS	$ 20,000	$ 20,000		
Sump (Weep Water) Pump	1	EA	$ 50,000	$ 50,000		2007 Godwin cost estimate
Sump (Weep Water) Pump VFD	1	EA	$ 30,000	$ 30,000		2007 Godwin cost estimate
HDPE pipelines (influent and effluent)	1	LS	$ 339,357	$ 339,357		Includes density meters, flow meters, and diffuser
Pipe road crossing	1	LS	$ 30,000	$ 30,000		
Fill material for slope filling	5,668	CY	$ 19.00	$ 107,692		
Fill material for cover construction (2.5-ft)	27,000	CY	$ 19.00	$ 513,000		
Top soil for cover construction (6-inch)	33,000	SY	$ 8.60	$ 283,800		
Water Treatment Construction					**$ 2,826,562**	
Treatment building	1	LS	$ 210,000	$ 210,000		Assumes 150 ft x 60 ft insulated steel bldg and using the former trim bldg slab
Concrete equipment pads	1	LS	$ 20,000	$ 20,000		
Pretreatment	1	LS	$ 714,350	$ 714,350		Based on vendor quote
Filtration	1	LS	$ 530,772	$ 530,772		Based on vendor quote
Carbon Adsorption	1	LS	$ 265,386	$ 265,386		Based on vendor quote
Backwash System	1	LS	$ 119,698	$ 119,698		Based on vendor quote
Effluent System	1	LS	$ 109,932	$ 109,932		Based on vendor quote
Water Treatment Mobilization	1	LS	$ 38,000	$ 38,000		Based on vendor quote
Water Treatment Mechanical Installation	1	LS	$ 117,269	$ 117,269		Based on vendor quote
Water Treatment Piping	1	LS	$ 240,769	$ 240,769		Based on vendor quote
Water Treatment Elect/I&C Installation	1	LS	$ 377,431	$ 377,431		Based on vendor quote
Tank Installation	1	LS	$ 7,692	$ 7,692		Based on vendor quote
Water Treatment Start Up & Test	1	LS	$ 20,264	$ 20,264		Based on vendor quote
Polishing Polymer System Chemicals	1	LS	$ 55,000	$ 55,000		Based on vendor quote and Includes chemical (polymer)
Dewatering Operation					**$ 3,719,730**	
Geotubes	140,257	CY	$ 6.28	$ 880,199		
Mobilization	1	LS	$ 250,000	$ 250,000		Assumes 5 people 24 hrs/day and equipment
Geotube Dewatering Operation	115	DAY	$ 9,000	$ 1,036,932		Assumes 5 people 24 hrs/day and equipment
Polymer System Equipment Rental	3	MO	$ 19,150	$ 66,859		2008 SNF cost for Waukegan (min. 6 mo lease)
Polymer	116,881	TON	$ 4.24	$ 494,990		Assumes 3.5 lb polymer/dry ton sediment
Chemicals	3	MO	$ 25,000	$ 87,284		
Operations (Dredging months)	3	MO	$ 180,000	$ 628,444		Assumes WTP Operation 30 days per month/$6000 per day
Operations (Winter months and cover installation)	5	MO	$ 35,000	$ 175,000		
Miscellaneous maintenance supplies	3	MO	$ 25,000	$ 87,284		
Discharge Monitoring and Reporting	8	MO	$ 1,500	$ 12,737		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 1,880,528**	
Mobilization	1	LS	$ 300,000	$ 300,000		For one 8-inch dredge
Debris Sweep	40	ACRE	$ 2,700	$ 108,000		
Dredging	105	DAY	$ 12,000	$ 1,256,888		For one 8-inch dredge
Dredge Monitoring	105	DAY	$ 810	$ 84,840		Assumes turbidity monitoring 5 day/wk and 24 hr/day
Verification Sampling	90	DAY	$ 620	$ 55,800		
Bathometric Survey	5	EA	$ 15,000	$ 75,000		
In Situ Cap/Cover Placement					**$ 3,416,987**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	9,162	CY	$ 32	$ 293,184		
Sediment cap - sand	7,713	CY	$ 20	$ 154,260		Assumes material is supplied from offsite
Armored Sediment Cap - armor stone	13,086	CY	$ 40	$ 523,440		
Armored Sediment Cap - filter stone	4,674	CY	$ 35	$ 163,590		
Armored Sediment Cap - sand	3,739	CY	$ 20	$ 74,780		Assumes material is supplied from offsite
Residual Sand Cover	46,242	CY	$ 20	$ 924,840		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 55,760**	
Transportation and Disposal of debris	1	LS	$ 50,000	$ 50,000		
Transportation and Disposal of Carbon/Sand Media to Landfill	240	TON	$ 24	$ 5,760		Assumes one full change outs of carbon @ 20 ton/vessel and sand @ 30 ton/vessel
Long-term Treatment System					**$ 100,000**	
Modifications to current treatment system for containment cells	1	LS	$ 100,000	$ 100,000		
Surface Restoration					**$ 21,600**	
Grading	3	AC	$ 3,000	$ 9,000		
Record Drawings/Topo Information	3	AC	$ 4,200	$ 12,600		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 16,973,215**	
Payment/Performance Bonds and Insurance (4%)					**$ 678,929**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 2,241,822**	
Contractor Fee (5%)					**$ 994,698**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 20,888,665	
Contractor Professional/Technical Services					**$ 981,182**	
Contractor Engineering/Design (2.5%)	1	LS	$ 424,330	$ 424,330		
Field Project Management (Dredging Operations)	3	MO	$ 75,000	$ 261,852		
Field Project Management (Winter and cover)	5	MO	$ 25,000	$ 125,000		
Home Office Project Managment/Procurement	20	MO	$ 8,500	$ 170,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 546,746**	
Contingency (20%)					**$ 4,177,733**	
Annual O&M-Year 1-30						
Consolidation Cell Cover Inspection and Repair	1	EA	$ 6,000	$ 6,000		Performed annually
Monitoring	1	EA	$ 6,000	$ 6,000		Performed annually
Containment Cell Water Treatment System O&M	1	EA	$ 4,000	$ 4,000		Performed annually
Subtotal				**$ 16,000**		
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 242,858**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 26,837,184**	

WAUKEGAN HARBOR SUPERFUND SITE
Alternative 5 - Capping
WAUKEGAN, IL
March 2008

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction Submittals					**$ 71,000**	
Safety Supply Allowance	1	LS	$ 36,000	$ 36,000		
Submittals	1	LS	$ 35,000	$ 35,000		
Setup of Temporary Facilities					**$ 454,000**	
Site Preparation	1	LS	$ 50,000	$ 50,000		Includes grading of the pad
Decontamination pad (20 x 40 asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Construction of haul road/access road	1900	LF	$ 50	$ 95,000		Assumes gravel road (20-ft wide and 8-in thick)
Maintain haul road/access road	3	MO	$ 10,000	$ 30,000		
Miscellaneous storage facilities, equipment, supplies	3	LS	$ 50,000	$ 150,000		
Perimeter fencing	1,000	FT	$ 11	$ 11,000		
Site Trailer and Utilities	6	MO	$ 3,500	$ 21,000		
Electrical Drop	3	LS	$ 25,000	$ 75,000		
Temporary Dewatering Pad Construction					**$ 275,000**	
Dewatering Pad/Jersey Barriers	1	LS	$ 200,000	$ 200,000		Jersey Barrier Berm & 40 Mil HDPE Liner
Pumps/Operating Controls	1	LS	$ 75,000	$ 75,000		
Water Treatment Construction					**$ 171,000**	
Frac Tank Storage	3	MO	$ 10,000	$ 30,000		
Treatment System Rental	3	MO	$ 47,000	$ 141,000		Based on 1000 gpm system rental
Dewatering Operation					**$ 305,848**	
Geotubes	13,000	CY	$ 6.28	$ 81,583		
Operations (Dredging months)	18	DAY	$ 6,000	$ 108,333		Assumes 720 cy/day
Polymer System Equipment Rental	1	MO	$ 19,150	$ 19,150		2008 SNF cost for Waukegan
Polymer	10,833	TON	$ 4.24	$ 45,879		Assumes 3.5 lb polymer/dry ton sediment
Miscellaneous maintenance supplies	1	LS	$ 50,000	$ 50,000		
Discharge Monitoring and Reporting	1	MO	$ 1,500	$ 903		Assumes reporting of PCBs, TSS, metals, and ammonia
Marina Removal					**$ 800,000**	
Partial Deconstruction and Reconstruction	1	LS	$ 800,000	$ 800,000		Based on revised estimate by John Moore 5/2/07 (48 slips)
Sediment Removal					**$ 396,667**	
Mobilization	1	LS	$ 150,000	$ 150,000		
Dredging	18	DAY	$ 12,000	$ 216,667		Sediment shallower than 12 ft LWD removed for placement of cap.
Bathometric Survey	2	EA	$ 15,000	$ 30,000		
In Situ Cap/Cover Placement					**$ 3,101,421**	
Seawall capping - armor stone	15,309	CY	$ 50	$ 765,450		
Seawall capping - filter stone	9,185	CY	$ 35	$ 321,475		
Seawall capping - bedding stone	6,124	CY	$ 32	$ 195,968		
Sediment cap - gravel	37,005	CY	$ 32	$ 1,184,158		
Sediment cap - sand	31,719	CY	$ 20	$ 634,370		Assumes material is supplied from offsite
Transporation and Disposal Offsite					**$ 149,415**	
Load trucks with dewatered sediment and geotubes	16,513	TON	$ 3	$ 49,538		
Transport dewatered sediment to landfill	16,513	TON	$ 6	$ 99,076		Estimate from Zion landfill
Transportation and Disposal of Carbon/Sand Media to Landfill	45	TON	$ 18	$ 801		Assumes 2 sand vessels @14,500 lb each and 3 carbon systems @ 20,000 lb each
Surface Restoration					**$ 14,400**	
Grading	2	AC	$ 3,000	$ 6,000		
Topsoil and seed	2	AC	$ 4,200	$ 8,400		
Demobilize					**$ 270,000**	
Record Drawings/Topo Information	1	LS	$ 15,000	$ 15,000		
Subcontract Project Closeout	1	LS	$ 75,000	$ 75,000		
Demobilize Equipment	1	LS	$ 180,000	$ 180,000		
SUBCONTRACT SUBTOTAL					**$ 6,008,751**	
Payment/Performance Bonds and Insurance (4%)					**$ 240,350**	Bond and Insurance only applied to Subtotal
Contractor G&A (12.7%)					**$ 793,636**	
Contractor Fee (5%)					**$ 352,137**	Fee should be applied to both Subtotal and Subcontractor G&A
					$ 7,394,874	
Contractor Professional/Technical Services					**$ 477,219**	
Contractor Engineering/Design (2.5%)	1	LS	$ 150,219	$ 150,219		
Field Project Management (Dredging Operations)	1	MO	$ 75,000	$ 75,000		
Field Project Management (T&D Operations and winter)	6	MO	$ 25,000	$ 150,000		
Home Office Project Managment/Procurement	12	MO	$ 8,500	$ 102,000		
Contractor Program Management						
Program Management Oversight (2.5%)					**$ 196,802**	
Contingency (20%)					**$ 1,478,975**	
Annual O&M-Year 5, 10, 15, 20, 25, 30						
Insitu Cap Monitoring (bathymetric survey)	1	EA	$ 15,000	$ 15,000		Performed every five years
Insitu Cap Repairs	1	EA	$ 25,000	$ 25,000		Performed every five years
Subtotal				**$ 40,000**		
O&M Present Value@ 7%					**$ 86,308**	
TOTAL ESTIMATED RA COST (FY 2008 DOLLARS)					**$ 9,634,178**	

TABLE C-1

Summary of Additional Cost for Removal of Sediment to -23 feet LWD

Capital Item	Alternative 1 - No Action	Alternative 2a - Environmental Dredging and Offsite Disposal	Alternative 2b - Environmental Dredging and Onsite Consolidation	Alternative 3a - Capping of North Harbor and Slip 4, Environmental Dredging and Offsite Disposal	Alternative 3b - Capping of North Harbor and Slip 4, Environmental Dredging and Onsite Consolidation	Alternative 4a - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Offsite Disposal	Alternative 4b - Capping of North Harbor, Slip 4, Marina, and Portions fo the Navigational Channel, Environmental Dredging and Onsite Consolidation	Alternative 5 - Capping
Pre-Construction Submittals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Setup of Temporary Facilities	$ -	$ 31,377	$ 23,075	$ 31,377	$ 23,075	$ 19,428	$ 22,406	$ -
Temporary Dewatering Pad Construction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Consolidation Cell Construction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Water Treatment Construction	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Dewatering Operation	$ -	$ 559,084	$ 559,084	$ 559,084	$ 559,084	$ 688,559	$ 753,073	$ -
Marina Removal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sediment Removal	$ -	$ 753,277	$ 753,277	$ 753,277	$ 753,277	$ 330,595	$ 330,595	$ -
In Situ Cap/Cover Placement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Transportation and Disposal Offsite	$ -	$ 986,235	$ -	$ 986,235	$ -	$ 986,235	$ -	$ -
Long-term Treatment System	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Surface Restoration	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Demobilize	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SUBTOTAL ESTIMATED COST	**$ -**	**$ 2,329,972**	**$ 1,335,436**	**$ 2,329,972**	**$ 1,335,436**	**$ 2,024,816**	**$ 1,106,074**	**$ -**
Payment/Performance Bonds and Insurance (4%)	$ -	$ 93,199	$ 53,417	$ 93,199	$ 53,417	$ 80,993	$ 44,243	$ -
Contractor G&A (12.7%)	$ -	$ 307,743	$ 176,384	$ 307,743	$ 176,384	$ 267,438	$ 146,090	$ -
Contractor Fee (5%)	$ -	$ 136,546	$ 78,262	$ 136,546	$ 78,262	$ 118,662	$ 64,820	$ -
Contractor Professional/Technical Services	$ -	$ 114,754	$ 71,338	$ 96,202	$ 71,338	$ 115,139	$ 92,171	$ -
Program Management Oversight (2.5%)	$ -	$ 74,555	$ 42,871	$ 74,092	$ 42,871	$ 65,176	$ 36,335	$ -
Contingency (20%)	$ -	$ 573,492	$ 328,700	$ 573,492	$ 328,700	$ 498,382	$ 272,245	$ -
Long-term Operation & Maintenance		$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL ESTIMATED COST[1]	**$ -**	**$ 3,600,000**	**$ 2,100,000**	**$ 3,600,000**	**$ 2,100,000**	**$ 3,200,000**	**$ 1,800,000**	**$ -**

Notes

1) Based on 2008 dollars

2) All numbers rounded to near $100,000